ELECTRICAL REVIEW

[ILLUSTRATED.]

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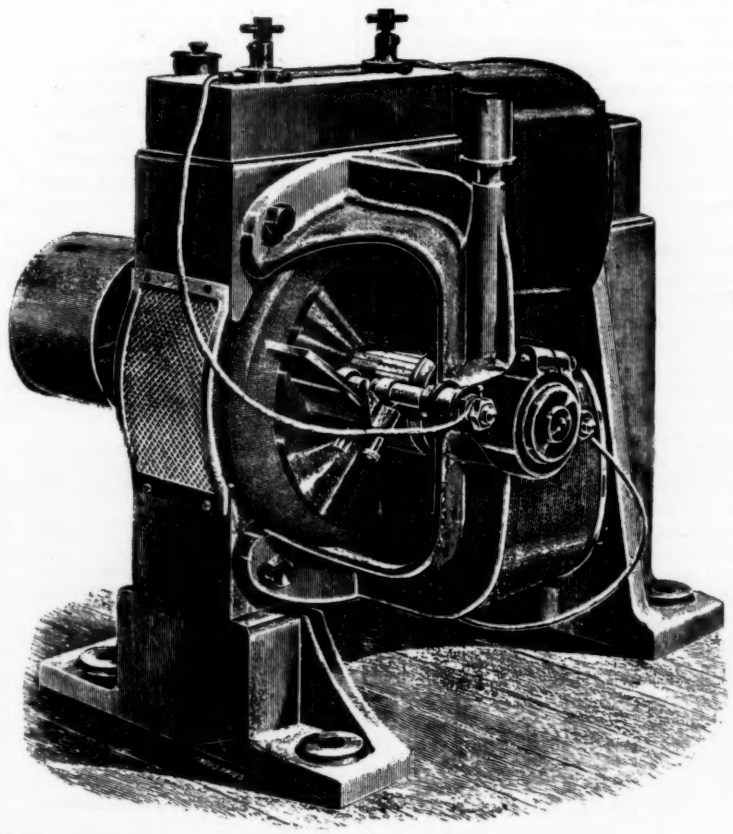
The Phœnix Arc Dynamo.

Whilst English makers have taken the lead in dynamos for incandescent lighting in parallel, it must be confessed that they have been outstripped by American electricians in the construction of high pressure machines for series arc lighting, remarks our contemporary, *Industries*. It would almost seem as if English makers, with one notable exception, had at first but little inclination to attack the problem of arc lighting on a large scale by high pressure machines, and hence a large number of such machines were imported from America; but it is satisfactory to see that some of the leading electricians in England are now beginning to turn their attention more seriously to this branch of the business. We illustrate herewith a machine, recently made for this purpose by Messrs. Paterson & Cooper, and called by them the "Phœnix Arc Dynamo" (single magnet type). The same makers have already, for some time past, been engaged in the manufacture of arc dynamos as a specialty, and several machines of the double magnet type have been running for some time at the Covent Garden Theater installation; but the machine here described is the first of the single horseshoe type. Machines of this description are usually arranged either with the yoke fixed to and forming part of the bed plate and the armature above, or inverted, that is to say, with a separate yoke above, and with the armature close to the bed plate, in which case the pole pieces must be supported by non-magnetic chairs. In the present machine, however, neither of these arrangements is adopted, the magnets being placed horizontally. The yoke is of cast iron, and the magnet bars are of wrought iron 6 in. square, and are excited by two coils. Each coil contains 954 turns of wire, and the two coils coupled in series have a resistance of 4.541 ohms. The armature is of the Gramme type, the core being $12\frac{1}{8}$ in. external and 9 in. internal diameter, whilst its length is equal to the width of the magnets, viz.: 6 in. The armature is wound with 1872 turns of 48 mils. wire, being arranged in forty-eight sections of thirty-nine turns each. The wire is wound in three layers, so that each section contains thirteen wires, side by side, and three deep, whilst the resistance of the armature is 3.448 ohms. The sections of the commutators are of hard drawn copper, insulated with mica, and the current is collected by copper plate brushes. It is stated by the makers, that, in future machines of the single horseshoe type, the horizontal arrangement will be abandoned in favor of the usual disposition of the armature above; but the yoke of the magnet will not be formed by the bed plate. It will be forged in one piece, with the two magnet limbs, the forging being of a U shape. In this way perfect magnetic conductivity throughout the field magnet circuit will be insured. The armature consists of wrought-iron disks, as usual, and a radial section contains 10 sq. in. of actual iron. The machine is constructed for a working current of 10 amperes, which is obtained at a terminal pressure of 700 volts, when the machine is driven at a thousand revolutions per minute. From these figures it will be seen that the electrical efficiency of the machine is 90 per cent., whilst the total strength of useful field is 416 lines (English measure), equal to 2,500,000 C.G.S. lines. The density of useful lines in the armature is 20.8, and that in the field magnets 11.6 per square inch (English measure), corresponding to an induction of 19,400 and 10,800 in absolute measure. The total exciting power of the field coils, which are coupled in series, is 19,080 ampere turns.



PHŒNIX ARC DYNAMO.

Fluorine.

Electricity, which has been the means of isolating a large number of the elements, has again been the medium of obtaining one of the most difficult elements to deal with, viz., fluorine. By electrolyzing hydrofluoric acid at a comparatively high potential, nearly 40 volts, the acid is separated into its constituent elements, hydrogen and fluorine. The isolation of fluorine will probably give rise to a long list of new compounds, as the nascent gas seems to attack nearly all known substances with avidity.

Electrically Illuminated Cars.

The Julien battery in use on the Boston and Albany railway for lighting cars is arranged as follows: On car No. 90, the battery consists of 60 cells, each measuring $6\frac{1}{2}$x$5\frac{1}{2}$ inches and 8 inches high, containing 19 plates, and weighing in all 27 pounds. For convenience in carrying, the cells are combined in boxes, and the entire battery weighs not far from a ton. It occupies a box under the center of the car, and wires lead from it to the lamps. The battery is charged during the day by the Weston Electric Light Company of Boston, the car being run on the side track back of the company's station near Columbus avenue, and wires being connected with the battery. It takes some seven or eight hours to fully charge the battery, and then it will run the lamps nine or ten hours. If all the cars belonging to the road were lighted by storage batteries, some other method of charging them would have to be adopted. In that case, each morning the batteries would be removed from the cars, and connected with wires from the electric station. After being charged, the batteries would be replaced in the cars ready for the night service.

Regarding the cost compared with the oil lamps, it is probably true that, in the case of the one car now equipped, the cost is a little more; but it is claimed that, when the expense of cleaning, filling, lighting and breakage is taken into account, the incandescent lamps have the advantage. It is estimated that the cost will be about 11 cents per lamp per day. So thoroughly satisfied are the officials of the Boston and Albany with the working of the experiment, that they have given orders for the immediate equipment of the entire trains which leave Boston for New York and New York for Boston at 4.30 P. M. daily. Other trains are to be equipped as rapidly as possible.

—— An ordinance granting right of way to the Penn Electric Light Company has passed the Philadelphia Common Council.

Extensive Business in Isolated Plants of the Edison United Manufacturing Co.

The general offices of the Edison United Manufacturing Company, at 65 Fifth avenue, New York city, present a very busy scene. It is here, under the general managership of Mr. J. Hutchinson, that all business in connection with isolated plants is concluded and ratified, and the work so far this year has been particularly large and gratifying to the energetic management The Edison central station lighting is all managed at 16 and 18 Broad street, where President Johnson and Treasurer Hastings make their headquarters; and this branch of the business has rapidly grown during the past year, a number of new and very complete central stations having been constructed in that time.

At 65 Fifth avenue the following list of plants are of recent sale: Toledo (Ohio) Insane Asylum, 1,750 lights; Aldrich Building, New York, 600 lights; Hotel Cambridge, New York, 500 lights; Hotel Ponce de Leon, St. Augustine, Fla., 2,500 lights. This is the first large installation in that State.

Tuxedo Park (club houses, cottages, etc.), 900 lights; Dick & Meyer, Brooklyn, 600 lights; Ocean steamship line, to Savannah, five steamers, 650 lights.

Olivette, the new and elegant steamer of the Plant Investment Company, of 12 West 23d street, has been fitted with 320 lights set in colors, making a very beautiful effect. This fine boat is still at Camp's shipyard at Philadelphia.

The New York Produce Exchange has increased its plant 400 lights; and the New York Athletic Club has ordered 250 additional; Messrs. John Duncan's Sons, 43 Park place, New York, have had their establishment lighted throughout by the incandescent light.

One representative, Mr. C. A. Benton, of this branch of the Edison business, has concluded contracts since July 1st, 1886, for 10,545 lights, nearly all of which are in New York city.

Incandescent Lamp Manufacture.

AMYLOID CARBON.

Most makers of lamps are now agreed that Swan was right when he insisted that lamp carbons should be homogeneous and structureless. The most important homogeneous carbon by far is prepared from amyloid. Lane-Fox was the first to patent carbon made by carbonizing parchmentised cellulose. He used vulcanized fiber, which is cellulose more or less parchmentised by chloride of zinc.

Swan, quite independently of Lane-Fox, worked out a carbon made from parchment paper or cotton.

The chemistry of the processes now to be described is somewhat obscure. Cellulose is nearly the sole constituent of such things as paper, cotton, linen, etc., and the object aimed at is to make a compound having the same chemical composition as cellulose, but very different physical characteristics. The process best known is acting by sulphuric acid. What is known as parchment paper, or vegetable parchment, is made by dipping blotting paper, or some loose textured, unsized paper, in fairly strong acid. The acid seems to convert it into a soluble body, and

partly to dissolve it, thus destroying the fibre. At this stage the action is stopped, and a tough, homogeneous, horny, semi-transparent substance is obtained. This can be made by a number of methods, and the substance seems to be the same though made by very different processes. The writer has called this substance amyloid, but he cannot now remember where he got the name from, or whether it is really a correct term. He thinks, however, it was given by Hofmann, and it may serve as a generic name for amorphous cellulose, however prepared.

The methods of making amyloid may be roughly divided into four classes. Cellulose may be treated with agents with a very strong affinity for water, such as sulphuric acid, zinc chloride, etc. It may be converted into a substitution product, as by the action of nitro-sulphuric acid, and the substitution product may be dissolved, and then precipitated in a non-fibrous form, and reconverted to its original chemical composition. Thirdly, cellulose may be acted on directly by a solvent, such as Schweitzer's magnet, and precipitated. Lastly, amyloid may be prepared by roundabout processes from such bodies as starch, seaweed, etc. This last is somewhat doubtful.

Cellulose has the composition $C_6 H_{10} O_5$, or some multiple of it. It therefore consists of the elements of water combined with carbon. Of course, it does not follow that the hydrogen and oxygen are combined in any way as water; but from the action of dehydrating agents it may be assumed that that is to some extent the case. If cotton wool is put in sulphuric acid of the right strength, the acid seems to abstract water and form a compound which is partly soluble in sulphuric acid of that strength. If the action of the acid is then checked by immersion in water, the compound seems to take up water again, and also to be precipitated. What the composition of the body is while partially dissolved in the action cannot be known; but it is hardly likely that it retains $C_6 H_{10} O_5$ right through, and it is more likely that water is abstracted by the acid, and is replaced again on dilution. This is the more probable, as various bodies act similarly on cellulose, which have no points of similarity among themselves except their strong affinity for water.

If the cotton wool were left longer in the acid, it would, on the addition of water, give dextrin, another substance with the same percentage composition as the original cellulose. The dextrin so formed is not quite the same as dextrin made from starch in the usual way, as it rotates the plane of polarized light to the left instead of to the right.

The sulphuric acid process may be described first, as it is by far the most important.

To make thread carbons, sulphuric acid is diluted to 1.64 s. g. Swan, in his specification 4,933, 1880, gives the best strength as 2 of oil of vitriol to 1 of water. This is somewhat weaker than 1.64, but the writer finds 1.64 best. The thread used should be of very loose texture, and still as even as possible. For carbons of ordinary 50 volt lamps knitting cotton is the best available material. No. 8 is a good size. For finer carbons embroidery cotton is better, and it is more even in texture. Swan mentions crochet cotton as the best, but crochet cotton is far too loose in texture for use. No doubt the best material for 50 volt lamps would be embroidery cotton also, but unfortunately it is not made thick enough.

Some practice is necessary to enable any one to make carbons successfully by the sulphuric acid process. In fact, all the amyloid processes are very troublesome. In order to get an idea of the process, a short piece of knitting cotton may be dipped in the acid, and held up and watched. It will almost immediately begin to get transparent, and the little strands on the far side will become visible, making the thread look as if it were plaited. Any little lumps or irregularities on the outside will sink in, and the material will gradually become like an even string of raw white of egg. It will soon break by its own weight, and if then laid on a piece of glass it will gradually become liquid, the cellulose being converted into dextrin. If, at the moment the cotton appears thoroughly gelatinized, and before it is soft enough to break, it is dipped in water and washed, the action is checked, and the amyloid thread is produced. On immersion in water the outside of the thread turns white, just as white of egg does in hot water. The thread gradually becomes white and opaque right through. If it is now thoroughly washed in water, and then hung up to dry, with a small weight to keep it taut, it will shrink a great deal, and dry into a horny thread. If the thread is cut, or if the rough surface is polished, it will be found to be colorless and nearly transparent, looking like catgut. No sign of the original twist of the cotton should be visible.

The great difficulty is to immerse the thread in water exactly at the right moment. If it is immersed too soon, the organic structure of the cotton is not completely destroyed, and if it is not immersed soon enough it falls to pieces, and is weak. If the acid is used weaker, the thread is not so thoroughly acted upon.

In the laboratory the cotton thread may be wound on glass rods or on frames, and dipped into the acid. In manufacture this does not give uniform results The cotton thread is therefore passed continuously through an acid bath into water. Large drums of copper gauze are slowly turned in tanks of water. These are driven from the engine, so as to get even motion. A drum of knitting cotton is mounted so that it can unwind easily. The thread unwound from it goes under the surface of the acid, being made to pass under a sort of glass bridge. On emerging it rises over a very loose-running porcelain pulley, and then goes down into the washing tank, where it is wound on the copper drum. The drum has a screw traverse motion, so that the material is wound on one layer deep. There must be very little friction in the system, otherwise the thread will break just before it gets to the water. The time of immersion of the thread is regulated by the length of the acid bath, the speed of the drum, and the distance between the acid bath and the washing tank. The writer prefers to put a glass T piece above the surface of the water. It is held in such a position that the thread passes through the cross-piece freely, and the shank is connected by a rubber tube to the water supply. The ends of the T are slightly contracted, so that the water squirts gently past the thread. By this means the action of the acid is suddenly and thoroughly arrested at a definite point. Sulphuric acid of this strength rapidly absorbs water from the air, so the bath must be covered over as well as possible, or else so little acid must be used that the bath has to be very frequently filled up with fresh acid.

The great difficulty is in always getting the same amyloid with certainty in manufacture. Probably it always contains a little unaltered cotton, some dextrin, and perhaps a little glucose. Slight differences of time of immersion, of strength of acid, or of temperature, will make very great differences in the carbons made by Swan's process. The writer finds the addition of metaphosphoric acid to the sulphuric acid beneficial. It seems to check the second action, or the formation of dextrin, so that strong acid may be used so as to convert the cotton thoroughly with less danger of the thread breaking just before immersion in the water.

Water is kept running through the tank with the copper drum, and when the drum is full it is put in another tank and left so that the thread may be very thoroughly washed. The least trace of acid left in the prepared thread is fatal, as it will act on it as the thread is dried.

To dry the prepared thread it is hung vertically or horizontally in such a way that it is always kept taut by little weights. It may easily be arranged zig-zag down the side of a room, passing over little loose wooden pulleys. One end is then fixed, and a weight is hung on the other. When quite dry and horny the prepared thread is taken down to undergo the next process, which is cutting down to gauge. This amyloid is exceedingly difficult to cut satisfactorily, as it takes the edge off such a thing as hard steel. It was only after great patience and many experiments that Messrs. J. W. Swan and Alfred Swan succeeded in cutting the material properly. A series of jewels like wire-drawing jewels are used; but the holes are cut differently. The holes are tapered one way only, so as to leave a sharp edge on one side, and the thread is drawn through, entering at the small end of the tapered hole. To give ease in starting, the dies are made to open, and when the thread is placed in them, they are held shut by springs, or are clamped. There is some trouble in getting such apparatus made well, and it is very much better to use dies that are not split. If the holes of the series decrease very little at a time, there is little chance of breakage of the thread, if care is used. Of course, the thread must be pulled through only one die at a time, not through five or six. Guides should be arranged so that the thread does not "chatter," else it may be cut all over little waves For experimental work a die may be made by drawing out a piece of glass quill in the blow pipe flame, and breaking it at the narrowest part.

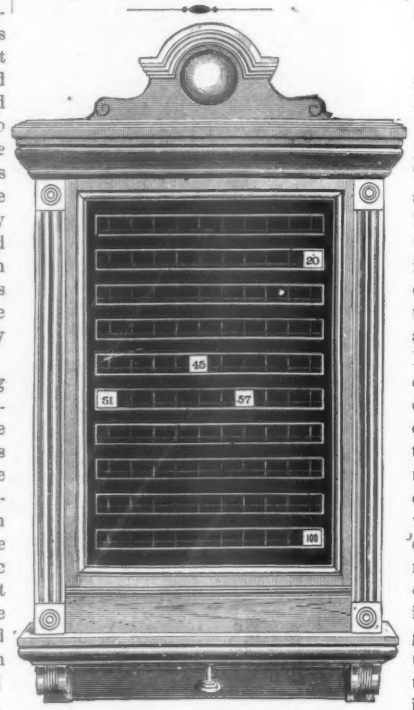
For flat thread carbons, a loose texture braid is used instead of knitting or embroidery cotton. This flat braid is not generally to be got very fine, so that such carbons can only be used for 40 or 50 candle power lamps.

The writer has had some beautiful, fine flat braids made for him by silk spinners. Some of these were fine enough to be used for 10-candle 80-volt lamps.

After being cut down to the right size, the thread is ready for carbonization.

It should at this stage be nearly transparent, like catgut, and there should be no traces of white fibers, or of the original twist of the cotton, visible in the center.

This material is very hygroscopic, and, swelling and contracting, is the cause of some error in the surface of the carbon. If the material is damp when cut down, it will make a thinner carbon than intended.—*London Electrician.*



Hotel Annunciator made by Hazazer & Stanley for E. P. Eadson, Atlantic City, N. J.

A novel feature of this annunciator, which is shown on this page, is that all the works are attached to a separate frame and can readily be removed from the case, all the wires being connected to the back board. The case may be taken down, and the works removed without having to disconnect any of the wires. This firm have a large number of contracts under way, among them being the Railroad Men's Reading Room, Forty-fourth street and Madison avenue, given by Wm. H. Vanderbilt for the benefit of the employes of the New York Central Railroad Company; Mr. Cyrus W. Field's residence, Twenty-first street and Lexington avenue; Ogden Mills, Sixty-ninth street and Fifth avenue. This is a fire-proof house throughout, and is wired entirely with lead cable. They also have two contracts for Lamb & Rich, architects; a large apartment house, Eighty-ninth street and Second avenue; a residence for Mr. Sanfoord, 812 Fifth avenue, which is being wired complete for call bells, burglar alarm and gas lighting. This is a fair indication of the extensive adoption of convenient electric apparatus for private as well as public houses.

ELECTRICAL WORK IN BOSTON.

Daily exhibitions of the Enos Electric Railway are given at No. 2 Pemberton square. The number of visitors is large. There is a good prospect that this system will be applied to some New England roads during the coming summer.

Now that no alarms of fire will be struck on the bells in a large portion of the city, the question has arisen as to the method of sounding no school alarms on stormy days. It is proposed for this purpose to place bells on each of the school houses.

At the meeting of the New England Association of Gas Engineers, held in this city Feb. 16 and 17, various questions relating to the operation of electric plants by gas companies was discussed.

Mr. Greenough, of the Boston Gas Company, submitted, at a further hearing before the Legislative Committee on Manufactures, a modified draft of Mr. Dillaway's bill, limiting the time to one year within which gas companies must furnish electric light after making application therefor. For the remonstrants there appeared President Price, of the Salem Electric Light Company, and Prof. John Trowbridge, of Harvard University, gave testimony as to the unsuitability of coke as a fuel for generating steam for electric lighting. He cited the experience of the Cambridge Electric Light Company, who had not obtained good results by the use of coke.

On a visit to the factory of W. S. Hill a number of interesting devices were shown. Attached to a motor in an arc circuit there was a commutating and reversing device, giving from 100 to 300 reversals per second. The current, varying in direction and intensity, passed through the coarse wire of a 17-ounce induction coil. To the secondary were attached four 75-volt 16 candle power incandescent lamps in series. The amount of energy wasted in conversion was not more than 25 per cent., as the coil did not heat above 130° Fah. The primary wire was No. 16 B. & S.; the secondary, No. 28. The output of the coil is unexampled, being one electrical horse power for every 3 lbs., 3 ounces of iron wire, copper wire and insulation combined. A dynamo with a commercial efficiency of 75 per cent., giving an output of one electrical horse power and weighing less than 40 lbs., has not yet been constructed. To show the counter electromotive force of a motor, Mr. Hill placed one of his motors in shunt to an arc lamp, turning on the current. The carbon points glowed dull red, and as the speed of the motor increased, the carbons drew apart. As the speed of the motor was reduced by grasping the shaft, the counter electromotive force would be lessened, more current would flow through the motor, less through the arc lamp.

The machinery of the Boston Electric Lighting Company, at both the Ferdinand street and Congress street stations, is under the charge of Mr. O'Neil. The Ferdinand street station has been slightly remodeled; the stairways have been moved, and a double screw elevator made by the Whittier Machine Company. The capacity is four tons. The heaviest dynamos are easily raised from the lower floor to the upper story. At present the second story is used as dynamo room, the belts running from counter shafts in the power room below. The

story above has been rearranged, a convenient and well-lighted portion being set aside for the care and repair of lamps. Behind this is the store room, in which a full line of supplies required by the various departments of the company will be kept in stock. A competent man will be given charge of this department. The company have always employed the most experienced workmen for their line department. When fixtures are placed on roofs the covering is removed, the fixture bolted to the roof, which is then placed in the best condition possible. In consequence of the fact that house owners receive no inconvenience from electric light fixtures on their premises, there is no difficulty in obtaining permission to place them.

The steam railroad companies are looking into the various methods of lighting trains by incandescent lamps. The storage battery will undoubtedly be put in use by at least one railroad leading out of Boston before the end of the summer. F. M. G.

BOSTON, MASS., March 21.

Electricity, What is It?

Gilbert in his book, "De Magente," 1600, first introduces the word "electric," deriving it from *electron* (Gr. *amber*), which was the only substance known to the ancients that acquired the property of attracting light bodies when rubbed. Gilbert gives a list of bodies, as diamond, sapphire, crystal, glass, sulphur, sealing-wax, and others, possessing the electric property, distinguished from magnetic power, the former attracting all light bodies, the latter, iron only. He regarded magnetism and electricity as two emanations from one fundamental force. He considered the earth as a magnet and the lines of equal declination and inclination as having their inflections determined by distribution of mass, or by the forms of continents, and by the extent of the deep intervening oceanic basins. Gilbert was surgeon to Queen Elizabeth and James I., and died in 1603.

Otto Guericke, of Magdeburg, discovered that there was a repulsive as well as an attractive force in electricity, observing that a globe of sulphur, after attracting a feather to it, repelled it until the feather had again been placed in contact with some other substance. Guericke observed his globe of sulphur, when rubbed in a dark place, emitted faint flashes of light; and shortly afterwards it was noticed that a similar phenomenon occurred at the surface of the mercury when shaken. This fact, Bernoulli, a celebrated mathematician, attempted to explain on the Cartesian system, but which was correctly attributed by Hawksbee to electricity. Wall, in 1708, observed the sparks produced from amber, and Hawksbee noticed these sparks and "snappings" under various modifications. Dufay and the Abbé Wollet were the first to draw sparks from the human body—an experiment which attracted great attention and became at the time a fashionable diversion. Newton, in 1675, observed signs of electrical excitement in a rubbed plate of glass.

Dufay, between 1733 and 1737, generalized as far as to lay down the principle that electric bodies attract those which are not so, and repel them as soon as they become electric by the vicinity or contact of the electric body. Dufay also discovered that a body electrified by contact with a resinous substance, repelled another electrified in the same way, and attracted one which had been electrified by contact with glass; concluding that the electricity so derived was of different kinds, he applied the names vitreous and resinous to them. Franklin attributed this difference to an excess or deficiency of the electric fluid, the former condition existing in electrified glass, and the latter in resins.

The discovery of the Leyden jar is attributed to Cunaeus, of Leyden, in 1746, who, in handling a vessel containing water, in communication with an electric machine, received a severe shock. It is said a similar event occurred the year previous to Von Klurst, a German prelate.

Gray, 1729, discovered that certain substances were possessed of a conductive, in contradistinction to an electric power; and afterwards Nollet passed a shock through a circle of 180 men of the French guards, and along a line of men and wires 900 toises in length, while Watson, the learned Bishop of Slandaff, in 1745, ascertained that the transmission of the shock through 12,000 feet of wire, was sensibly instantaneous. He signaled an observer by this means.

New Electric Device for Advertising.

The Electric Advertising Company, of Springfield, Mo., own the patent on a device for presenting cards of advertising matter in an interesting manner The box or cabinet shown in the cut contains a small battery and electric motor in the back part, which runs an endless belt. The belt catches the cards from the rear and transfers them to the front, and as fast as one card is removed another falls down the inclined plane in its place. The changes are made every 30 seconds. Each box contains 70 cards, about eleven inches long. The exploiters expect to grant rights to place these stands in public buildings and furnish all who may care to stop and read a continuous round of attractive cards.

Report on the Installation at the Prince of Wales' Theater, London.

Our esteemed contemporary, the London *Electrical Review*, publishes the following concerning this plant:

The plant comprises a 12 horse power Clark's gas engine, manufactured by L. Sterne & Co., 1 Siemens D_1 dynamo, an E.P.S. battery of 53 cells, and 360 Swan lamps, 108 volts, 16 candle power.

In placing this report before your readers, my firm must candidly express the great satisfaction the gas engine has given ever since its erection. During the past year it has run 2,895 hours. The only repair that the engine has had since erection is the annual cleaning of the water jacket on account of the deposit of lime which we find comes from the circulating water. The other repairs have been trifling. The slide now working was put in in June, 1885, and has not been refaced. The bearings have not been touched: the latter, no doubt, is helped

by using nothing else than castor oil, which we consider best for heavy bearings.

The engine, besides running the dynamo, also drives the pumps for the hydraulic machinery for the iron fire-proof curtain on the stage, and for the hydraulic lift. The dynamo has this year been more satisfactory than the last, only six pairs of brushes being used, and it has only been turned up once, and has not given any trouble whatever.

With regard to the accumulators, the glass cells which were put in about 18 months ago are still working well; only seven of them have had to be taken out and the plates straightened; although put to very heavy work the remainder are in capital condition. In October last 24 of the old teak boxes were taken away and replaced by 48 glass cells; these have all worked admirably, being now in splendid condition, and showing a fine dark chocolate color on the positive plates; the negative plates only show a very slight appearance of blistering.

The lamp renewals show a larger average than before, owing greatly to a number of old lamps giving out their life. There are several lamps still running that were put up when the theater was built, and have stood the greatest work, and are still working, having run over 3,500 hours.

During the year we erected a batten with 12 lamps under the painting-room floor which overlaps the stage, and 8 lamps under the stage, gas being found too hot and the men being unable to work, there being very little ventilation there.

These lamps are greatly appreciated by those working under them. The renewals are as follows:

Loops, 31; accidents, 21; filaments, 70; total, 122. Of these we have been able to repair 28 lamps of the broken loops. The theater was closed three works in July, but there have been 46 morning performances.

Subjoined is an abbreviated account of the working expenses:

Electrician and assistant	£221	2	6
Gas used by engine	189	4	0
Lamps	25	5	0
Oil for engine, shafting, dynamo and pumps	8	8	0

NEW BELL OF ELECTRIC GAS LIGHTING CO., BOSTON.

Waste for above, and sundry other purposes	1	15	0
Six pairs of brushes	1	17	6
Lamp shades	0	9	6
Sundries	4	0	0
	£452	1	6
Repairs:			
Accumulators	£186	0	0
Dynamo	0	12	0
Engine	4	4	0
Belts	4	10	0
	£195	6	0
Total for working	£452	1	6
" " repairs	195	6	0
	£647	7	6
Total for two previous years	£1,131	5	10
Grand total for three years	£1,778	13	4

Certificate from E. Bruce, Esq.

PRINCE OF WALES' THEATER,
March 2, 1887.

Another year is now completed, making the third since the electric light was installed at my theater, and again I have nothing but praise to give to those concerned for its very successful working; in no instance has it failed. I have made further use of it on the stage for lighting effects in "Alice in Wonderland," and am thoroughly satisfied at the results obtained.

(Signed) EDGAR BRUCE.

Bell of the Electric Gas Lighting Co., of Boston.

The bell which we illustrate above has several novel features. The working parts are secured to a cast-iron bed plate, thus preventing all warping. The position of the armature is adjusted by a compound screw; by turning this the bell may be accurately adjusted for different currents, or for varying loudness. The contact points are of platinum, and the insulation and workmanship leave nothing to be desired. The clumsy hooks are in this bell replaced by a catch, by which the cover is quickly and easily removed or replaced.

The Discovery of Aluminum.

ITS HISTORY, OCCURRENCE, PROPERTIES.
PHILADELPHIA.

Few discoveries in modern chemistry, says *Engineering and Mining Journal*, have excited more general interest than that of the extraction from ordinary clay of a metal which, by whiteness, brilliancy, resistance to tarnish, strength, malleability, and great lightness, as compared with the hitherto well known metals, seemed to render it peculiarly fitted for many purposes in the arts, and caused aluminum to be hailed as "the metal of the future." Hence it is that, since 1854, Henri Sainte Claire Deville having succeeded in producing this metal in such quantities that it could be successfully wrought, the attention of many chemists and metallurgists has been turned to its more economic production. The attempts to get it directly from alumina, its only oxide, by the reducing action of carbon, as iron, zinc, tin, lead, and copper, and even potassium and sodium, are reduced from their respective oxides, have, unil very recently, proved unsuccessful, and its attraction from the native double fluoride, cryolite, from the artificial chloride, in both cases by the intervention of metallic sodium, has been the only available method.

A guide to our knowledge of the properties and mode of production of this metal was much needed in technical literature, and this want Mr. Joseph W. Richards has endeavored to supply by his lately published volume, now before us, in which a great number of facts relating to the history and mode of production of aluminum, its properties, and those of its alloys, have been brought together, making a very useful compendium. In his desire to gather information on the subject, the writer has embodied the claims of many would be inventors, whose pretensions are, to say the least, among the curiosities of technical literature.

The hitherto generally followed method of producing pure aluminum, by reduction of its chloride by sodium, is set forth in considerable detail, and the new and ingenious process of Castner, already described in our columns, by which the cost of producing sodium appears to be greatly cheapened, is fully described in this connection. Electrolysis, as applied to the decomposition of the fused aluminum chloride, is also explained, and the various more or less questionable plans for obtaining aluminum by the electrolytic decomposition of solutions of aluminous salts are described. Some of these have probably no better foundation than that of an ingenious novice, examined by the present writer, in which an acidulated solution of alum, with an electric circuit and an anode of metallic tin, effected a dissolution of this and its deposition at the cathode, where it was taken for metallic aluminum.

The remarkable invention of the Brothers Cowles, of Cleveland, in which the intense heat of the electric current passing through a resisting medium is made a means of directly affecting the reduction of alumina by carbon, and the production on a commercial scale of valuable alloys thereof, is explained at some length. The accounts of this by Prof. Charles F. Mabery and Dr. T. Sterry Hunt, already familiar to our readers, are freely laid under contribution. The latter has just called our attention to a statement attributed to him in this volume (pages 196 and 303) that the Messrs. Cowles have obtained "a compound of aluminum and nitrogen." This arose from the mistake of a reporter at the Washington meeting of the National Academy of Sciences, in April, 1886, whereat Dr. Hunt referred to a product got by attempting the reduction of titanic oxide in the Cowles furnace, which was conjectured to be a compound of titanium and nitrogen, such as is well known to be easily formed at elevated temperatures.

It may be here added that the operations of the large dynamo of 500 horse power at the new works of the Messrs. Cowles, at Lockport, N. Y., have been so successful that two others of the same size are said to be in process of construction, and moreover, that the production of pure aluminum by their process seems no longer a problem; although the demand for aluminum bronze is such that its fabrication engages the chief attention of the manufacturers.

The curious and varied information regarding aluminum presented in the volume of Mr. Richards is sufficient to show how wide a prospect is still offered by the many alloys of this metal; and the cheaper production of these already effected by the process of Messrs. Cowles, as well as the possibilities offered by improvements of the old method by cheapening the price of sodium, are such that scientific inventors have still an important and most inviting field of labor before them. We hope that Mr. Richards will soon find a new edition of his volume called for, and that he will see the desirableness of a critical revision of some portions thereof. Notwithstanding its defects, however, he has rendered to the public a valuable service, and we trust to hear from him again on the subject of aluminum.

ELECTRICAL REVIEW

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GEO. WORTHINGTON, - - - Editor
CHARLES W. PRICE, Associate "
LOREN N. DOWNS, President.
ANDREW J. DAM, - Vice-Pres't and Treas.
C. C. HASKINS, } Consulting Electricians.
GEO. A. HAMILTON, }

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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Frank M. Gilley, 54 Equitable Building, Boston, Mass., is our New England representative.
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NEW YORK, MARCH 26, 1887.

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An armature four and one-half inches by eight is very small from which to satisfactorily light 100 Edison 16 candle incandescent lamps; yet this result is reliably reported to have been obtained from a newly-constructed dynamo armature tested in this vicinity, last week.

Electric bells saved many lives at the recent hotel fire in Buffalo.

The citizens of Buffalo seem to think four days' notice abundant time in which to bury electric wires. If this be true, the New York and Brooklyn Subway Commissioners have frittered away nearly two years of valuable time.

The *Evening Sun* suggests that city fire departments be equipped with strong shears, on long and insulated handles, for cutting wires and cables when necessary to rescue persons from burning buildings. This has been done by the fire department of Kansas City, whose chief is the inventor and patentee of just such shears. This appliance was adopted some two years ago, yet has, we believe, never been used—because not needed.

The Electric Club at the nominating meeting held at the club rooms, March 21st, nominated officers for the year commencing May 1st, 1887. Two tickets were placed in the field, slightly differing, and will be voted on April 21st, on which date the club will hold its annual meeting. A special committee, consisting of Messrs. Price, Goodyear, Stanley and Barney, was appointed to arrange a programme of entertainment for the anniversary evening.

The storage battery business is looking up. The Electrical Accumulator Company, of this city, owning the patents of Camille Faure, and others, has commenced suit against the Julien Company and against the Brush Company for infringement. The two most active companies working in this field are the Electrical and the Julien, yet the Brush Company has experimented largely in the past, and owns several early patents covering the work of Mr. Brush.

Still "the winds and the weather" are making it uncomfortable throughout the northwest. The telegraph people suffer. Only a few days since "one frail, patched up wire, extending in a zigzag, circuitous way, from Chicago by way of Deming, N. M., and Los Angeles to San Francisco, was the only medium of telegraphic communication" between the cities of the east and the country west of the Rocky Mountains. The series of storms lasting some three weeks appeared to be enjoying a sort of meteorological carnival, and wound up with the Mardi-gras festivities over on the banks of the Mediterranean with one grand whoop-hurrah-set-em-up-again yell.

Down in Tennessee the Supreme Court has undertaken to smash one of our traditional idols: something about the transmission and delivery of messages, refunding only the tolls paid—or something of that sort. The court decided the other day that the "conditions and contract" on blank messages of a telegraph company are not binding on the sender of a message, though he may have knowledge of them, they being invalid, as the company cannot contract against its own negligence.

"It was remarked when Edison invented his phonograph," says the Philadelphia *Ledger*, "that by its use the speech of great orators and actresses could be reproduced so that succeeding generations could hear the actual tones of their voices reproduced after their death. This is the case now with Mr. Beecher. Mr. Edison has a large and very fine phonograph, with a cabinet of the utterances of great orators and others, among them Mr. Beecher. The voice of the famous preacher, though stilled by death, may yet be heard whenever Mr. Edison chooses to put in his phonograph the sheet of tin foil which bears the indentations corresponding to Mr. Beecher's utterances. Some of the phonographs that have been made, while preserving the characteristic tones of the voice, give them a sepulchral character; but Mr. Edison's instrument is so nicely adjusted that there is scarcely a perceptible difference between the voice of the speaker and that which the phonograph produces. It is certainly a strange reflection that Mr. Beecher's voice may still be heard by actual sound in the world."

THE ELECTRIC LIGHT EVEN IN PITTSBURGH!

The address on the new electric lighting system at Pittsburgh, Pa., was one of the most important delivered before the recent Electric Light Convention. Most of those who listened to this address or read it afterwards were, it is safe to say, so struck with the novelty of the new system as to pass unnoticed the auxiliary points brought out pending the description. To our mind, however, one of these points was very important, quite as much so, indeed, as the main subject, of which it was used as an accessory. We refer to the fact of the popularity of the electric light in Pittsburgh, the home of gas making products, and where, in consequence, gas light, which is thought to be electricity's rival, may be had at absurdly low figures. The new system of electric lighting at Pittsburgh has not, as was admitted by its sponsors at the Convention, been long enough in practical operation to give absolute assurance of commercial success. It has, however, furnished excellent circumstantial evidence in proof of this. But there is proof beyond peradventure that even in Pittsburgh the electric light can compete with gas light, and this, as we said before, is of surpassing importance.

The old sayings, "Carrying coals to Newcastle," "Sending cutlery to Sheffield," used to indicate the extremes of commercial idiocy, have been somewhat modified of late years, since a profitable market has been found in Sheffield for certain descriptions of American cutlery, and, for the same reason, taking artificial light to Pittsburgh, where it was supposed it could be generated cheaper than at any other part of the country, seems now, when the thing has been accomplished, not so absurd after all. But if a profitable market can be found for the electric light in Pittsburgh, at the coal and gas headquarters, how can any reasoning human being longer deny that electricity is to furnish the coming light all over the country?

We do not mean it to be inferred from anything we have said here that electric illumination can be furnished at Pittsburgh for a less or even the same price at which coal gas can be furnished. Even the sanguine sponsors for the new electric lighting system admitted that it could not be. But the Pittsburgh people, like all other communities where both coal gas and the electric light have been tried and compared, have shown a willingness to pay the additional cost of electric lighting service because it is infinitely better. This is the claim that electric lighting people of intelligence have all along pressed forward, and it is on this promise of efficiency, cleanliness and heathfulness, that they may hope to succeed wherever they are given the opportunity of comparison.

BOOK REVIEW.

"City and House Lighting," by M. Ph. Delahaye, published in French by G. Manson, Paris, 1886.

This work presents in a simple form, a complete description of all kinds of illumination employed at the present time. The first part of the work is devoted to the progress of illumination, not going much into historical details; but, beginning with the illuminants of the early part of the present century, it gives a comprehensive account of the art at that time and follows it down to the present time, going into details which are often difficult to find even in technical books. The plan of the work permits the author to pass successively in exhaustive review the different kinds of artificial illumination which have been at various times adopted, beginning with the candle and ending with the incandescent light.

The first chapter presents the first principles of combustion and illumination, going thoroughly into the subject and yet not using technicalties which the general reader would not readily understand.

The second chapter, entitled, "The Illumination of the Dwelling House" shows the various resources which can be brought into requisition for this purpose: candles, vegetable oils, mineral oils, carbureted vapor, including natural and artificial gas and electricity are treated with profuse and elaborate illustrations.

The industry of lighting or the commercial problem of illumination is reserved for the third chapter. The author revivifies the technology of gas manufacture, giving it a freshness which is pleasing in a subject which has been so often and thoroughly discussed, giving many practical directions and some which are often unknown to the majority of manufacturers.

The many illustrations of novel and ingenious burners and various gas appliances make this portion of the book very attractive.

Portable gas apparatus, machines for the manufacture of naphtha gas, water gas and the control of natural gas have considerable mention.

As to the electric light, it is presented in every form in which it has found practical application. Dynamo machines, regulators, current converters and lamps of every description and make are described in detail.

The fourth and last chapter is devoted to lighthouses, maritime illumination and the practical illumination of mines; for which the author has not only done considerable original work, but has compiled all of the best published accounts which have of late appeared in France and Germany.

The book can be furnished through this publishing house at $5 per copy.

OUR CHICAGO LETTER.

Cook county, Illinois, is in a sadly demoralized condition, because of sundry and several indictments which the special grand jury has found aginst certain "boodlers," whom, it is claimed, have been increasing their bank accounts at the expense of the honest taxpayers.

The other day the paper which has done most to bring this all to a head was moved to make some remarks—of course a daily newspaper is expected to say something every day—rather derogatory to certain city officials, as follows:

An instance in point. Some time ago some merchants doing business near the corner of State and Madison streets wanted to light their stores by electricity. They found they could do this most cheaply from one central plant. But one of them was on the opposite side of the street from the others. On inquiry they found they would have to get the consent of the Council to run their wires across the street. They couldn't get it. Just why, they couldn't easily find out; but they couldn't get it. They worked hard and made every proposition but the right one, until at last a lawyer called and informed them that they could get the permission they wanted for $600, and no less. When he convinced them that he really spoke by authority, they concluded to go ahead without permission, and so they got some experts and put a tube through under the street, so deep down as to be below any possibility of interfering with water or gas pipes, or anything else, and started their light. When their lamps began to blaze, trouble began. Notice was served from the City Hall that the light must be shut off or the underground wire would be cut. A number of conferences followed. A lawyer was employed, and Mr. James Armstrong, one of the parties, and a very good man in fight when he once gets in, resolved to see the thing through. In order to delay the threatened cutting of the wires until the case was fully considered and all the equities ascertained, he gave his personal bond in $2,000. Then the matter rested for awhile, and the lights continued to burn brightly whenever wanted. The merchants were happy. Their customers had plenty of light, and so far as they were concerned there were no anxiety to do more. But the authorities at the City Hall were not so well pleased. They began to send their emissaries around again, and insisted that something be done. Then the lawyer was sent over to ask what would be done in case the merchants did nothing further. He was told that the wires would be cut.

"And why will they be cut?" he asked.

"Because they were laid without permission of the Council, and that was illegal," was the reply.

The lawyer frankly admitted that it might have been illegal at the time, but that by accepting Mr. Armstrong's bond they had made it legal, and his clients would do nothing further. And they have not; but they have had no further trouble.

Now, to a man up a tree, all that looks like a chance for somebody to be "pulled" by a grand jury. It is merely a case of underground privileges—of franchise. The Chicago Electric Sectional Underground Company have complete control and ownership, so to speak, of all this underground business, and the authorities are only protecting the rights of that company when they refuse to countenance an infraction. The underground people set their price for the privilege asked, and have not enforced their claim, while the bond given against damage to city property, pipes, sewers, etc., satisfied the city hall officials—and that is all there is about it. The newspaper man, however, made his chunk.

To sum up as would an attorney:

The newspaper man got his work in and was satisfied.

The city got its bond and was happy. The underground folks put the charge in such a shape that they may enforce it at any time, and are content. And the electric light people are running their lights in peace, and are pleased.

Chicago to-day can perhaps boast of more only and original first-foremost-and-before-the-rest-of-'em telephone inventors than any other two cities in the Union. First of all, of course, is the Gray; then there is the American—the Cushman; there is the Pratt and Plumb; the McDonough; and the Strong; two have come to the light of day within the past few weeks—the Equitable, with $1,000,000 capital stock, and Geo. C. Sawyer, Geo. H. McDonald, and John G Stephenson incorporators; and the North American, with $750,000 capital stock, and David H. Robbin, Geo. S. Baker, and a third party, name unknown, incorporators.

When the little wanderer asked somebody if he had seen his father and was asked who his father was, he looked up astonished, and said, "don't you know my father? I know him jest as easy!"

An inquiry from one of the above telephone gentlemen, published in the *Inter-Ocean*, reminds one of the above, and is quite refreshing, after all the gratuitous advertising that has been done for the system alluded to during the existing season of telephone unpleasantness. No charge is made for the publication of the letter, the "at any cost" offer to the contrary notwithstanding. Only one condition is insisted upon: Mr. McDonough must use some other medium than the REVIEW, should he desire to know who H. C. Strong is:

WHO IS MCDONOUGH?

Chicago, Ill., March 9.—The Washington telegraphic item of March 8 in the *Inter-Ocean* gives "further proof in regard to the operativeness" of telephone patent shysters in the pay of the American-British Telephone Company, of Boston. The collusive litigation now in progress by the Boston "crowd" does not satify the plunderers, but they must trot out McDonough, of Chicago. The McD. patents are worthless, and the evidence is not wanting that will show it. The whereabouts of McDonough I cannot ascertain. Where does he hail from? Let us have the truth, at any cost.

H. C. STRONG.

After the telephone the accumulator. A suit was begun by the Electrical Accumulator Company, of New York, in the United States Circuit Court at Cleveland, on the 17th instant, against the Brush people. The suit is to sustain the Faure system, and suppress the Brush. Both parties have patents, and both are of course the great and original inventors.

An anecdote applicable to this sort of priority is told of an expert who was recently called to sit in judgment on an electrical apparatus claimed by the inventor—the system was for sale—to be in every respect clear of any other system, and it was intimated that a favorable report would be very acceptable. ($)

When the report came, it distinctly specified no less than ten palpable infringements of a common and well-known system of similar apparatus.

Messrs. Munson & Co., of 240 Randolph street, are working quite rapidly into the good graces of the electric people who have only to try their belting just once, to be convinced. They have equipped the Wunder & Abbott Illuminating Company, including one of 28 inch width; a 22 inch belt for the Edison Station at Elgin; the city plant here in the City Hall: Fowler & Sons, Kansas City, and the Atchison Electric Light Company, at Atchison, Kansas, are, among others, run by Munson & Co.'s belting.

CHICAGO, March 21, 1887.

BOSTON ELECTRICAL NEWS.

Boston is having a boom in incandescent lighting. Counting all lamps run by multiple series systems, secondary generators and multiple arc from central stations, there are nearly 10,000 incandescent lamps in use, not counting isolated plants. Since the Edison station was placed last August under the management of Mr. W. J. Hammer, so satisfactory have been the results that a second station is to be built about two-thirds of a mile to the north, at the foot of Beacon Hill.

The West End Railway has secured enough stock to control the South Boston, Cambridge and Metropolitan horse railroads, besides receiving location of its own in the Back Bay or West End of the city. The Suburban Railroad is under the control of the same persons, and is nothing more than a name for a portion of the West End Railway syndicate's system. The West End and Suburban tracks have been laid on paper only as yet. The proposition to tunnel Beacon Hill is not considered to be a serious one Before the first of May an experimental car is promised, and if successful, storage batteries and electric motors will be used over the entire system.

The New England Telegraph and Telephone Co. will not renew the work of extending their underground system until the last of April. They have been replacing some twenty-seven conduction cables, extending from the main office to Exchange street, by 100 wire cables. The two hundred additional drops, which were expected to fill all demands for increase of service, have already been taken. The feelings of subscribers toward the company have entirely changed during the last two years. Where it was, "If you can't make this telephone work, you can take it out," it is now, "Won't you please send a man down here to see to the telephone," etc.

The pressure upon the Legislature to fix a rate for telephone service in Massachusetts grows every year less. Last year, in two days, over 700 strong remonstrances were received from prominent firms using the telephone, against any legislation meddling with the telephone service. This year a circular was sent by the perennial telephone agitators to every telephone subscriber asking for signatures to a petition praying the General Court to limit telephone charges, and promising that if suitable signatures were obtained the measure would become a law. A monster petition of 30,000 names was presented, containing, out of the 4,000 subscribers of the company, less than 200. When we consider the vast number of names that can be obtained for any petition, even one to hang the governor or suspend the right of *habeas corpus*, the general satisfaction with the service of the company becomes apparent. Thousands of names on the petitions were those of persons who did not know the difference between a telephone and an ear trumpet.

It has become the fashion, when there arises a desire to eliminate any evil from society, to enact that instruction in that branch be given in the public schools. To help the cause of temperance, the children of tender age are taught how to make distilled liquors and alcohol, and the deadly effects of the seductive cigarette are favorite themes for denunciation. A certain class of people of some influence in legislation, on account of their persistent efforts, want to regulate everything under the sun. It is rumored that one crank has drawn up a bill which forbids the breaking of a wire from any cause. It only required the vote of both houses and the approval of the Governor to enable us to fly and walk on the water.

BOSTON, Mass., March 22, 1887.

In the terrible fire at Buffalo on the 18th instant, the people in the Richmond hotel who were saved, owe their lives largely to the electrical bells, which, when the fire was discovered, were at once turned on by the night clerk, Wm. H. Alford. But for this apparatus, so rapid was the spread of the flames, that a very much larger per cent, of the sleepers must have perished.

THE ELECTRIC CONSCIENCE PERSUADER.

(PATENTED.)

"Hooray! Ah! I have got it!" cried Jones, as he rushed frantically into my office. Before I had time to recover from my astonishment at the behavior of Jones, who was generally a very sedate and methodical person, and to ask him what he had got, he seized me by the hand, wrung it violently, and then executed a grand pas-de-suel in the center of the office.

"Jones has them!" I mentally remarked.

"Gaze upon me," he said; "look well upon these features; mark you the divine inspiration." He paused. Jones' face was dirty—looked as if he had been struggling with a coal heap.

"No," I said, "I don't quite see, but perhaps it's under the smut."

"Hang the smut," he said. "I am greater ——." He paused. "Yes, far greater than ——." Then turning to me, he said more quietly:

"I have made a great discovery."

"Ah!" I said.

"You don't enthuse for a cent," said he; "but, never mind, I will astonish you."

"Now," said he, "you doubtless have observed an ambitious tendency in all people engaged in dispensing that great wonder of the age, electricity."

I admitted that I had noticed a slight inclination to exaggeration on the part of agents of electric companies.

"Just so," said he; "they all do it—rather talk than eat! and that's saying a good deal; but they can't help it—they can't help it."

"Why?" I inquired, "that's nonsense!"

"Is it?" he said. "Listen: I have made a discovery. I have found out that there is a certain subtle something pervading an electric current, which, when it enters the human body, transforms a man of the strictest probity and conscientiousness into an infernal—well, a disciple of Ananais."

"Been in the neighborhood of a current?" I asked.

"Peace, you scoffer," he replied; "I will convince you, and, what is more to the point, I will show you that I can cure this desperate ill."

He took a piece of paper from the desk, and rapidly wrote this note:

James P. Skilkins. "Claim-All Creation Electric Light Company, 33⅓ Broadway."

JANUARY 19, 1887.

Dear Skilk:—Come to Thompson's office at once, have a big contract for you if you can convince parties of the great superiority of your system.

Yours, JOHN JONES.

"Just you wait, you doubting Thomas, till he gets here," he remarked.

In my office the illumination is by means of the Edison current. Jones reached up, removed the lamp from the socket, and inserted a plug, from which depended two fine wires. One of these he fastened to a chair, and the other he left hanging loosely behind the chair. I asked him what he was doing.

"Dry up!" he said, "and take off your hat, so that your hair can more conveniently stand upon end, when you can see what I can show you."

He had scarcely finished his preparations when Skilkins entered You all know what a dapper little fellow Skilkins is—always happy, always has a joke, and is invariably ready to explain "our system."

"Ha! Jones, old boy," he said; "contract, eh! Morning, Thompson! I tell you I feel fine. Just had a note from Fall—great inventor, Fall. Say, where the devil is that letter—oh! yes—says"—and he read from the letter. "Says, 'Dear Skilkins:—You will be glad to learn that at a test of our latest machine No. 341 made this morning, we got 14 2,000 candle power lights; $\frac{1}{16}$ inch belt; indicated horse power $1\frac{1}{2}$; push things. Yours, FALL.'"

"Now, gentlemen," he continued, "show me the machine that can beat that. I tell you"—Jones now forced him gently into the chair; at the same time picking up the wire that hung free at the back, and, seemingly, carelessly holding it in his hand, which rested on Skilkin's knee. Skilkins continued: "I tell you it's the"—his eyes seemed to wander for a minute, and his utterance was rather impeded—"I tell you Fall, the——, what does he take me for; the idiot—more likely got one light from 14 horse power than the reverse. I tell you, gentlemen, it's no use; I would not advise you to use our system; its no good! Confound it, we have to build a board fence around each machine to keep the engineer from being killed by the flying nuts. Damn thing won't run a month." Jones suddenly removed his hand from Skilkin's knee, and Skilkin's continued without an apparent break in the continuity of his remarks: "It's the grandest achievement of the age—our system will beat the world."

To say that I was mystified by the sudden changes in the tone of Skilkins' remarks hardly explains my feelings. I was dazed. Jones got rid of Skilkins somehow; how I don't know. I was still pondering deeply when he touched me and said:

"Well! Great scheme, eh? Now I tell you I am going to patent this thing, and sell one to every city, town and village in the country. It's a big thing. I call it the inner consciousness persuader. You see, when a town is in possession of my improved apparatus, the approach of an electric light agent will have no further terrors. After being permitted to dilate upon the merits of his 'system,' he will be invited to take a chair—the 'fatal truth' chair. The current will be turned on, which, acting homeopathically, will immediately cause him to 'cease his exaggeration and to tell the truth.' My dear boy, look upon me once more; can you not hear the shouts of grateful humanity? My ears ring; I laugh; I sing!!! Just lend me ten cents to get a bite, will you, and I will repay you one hundred fold at Del's when I get my invention in operation."

Jones left me. I have been thinking of his invention ever since, and, while I don't like to give him away, still I want to warn all those whom it may concern to look out for the "Electric Conscience Persuader."

Queries and Answers.

To the Editor of Electrical Review:

1. Will you kindly tell me how I can make wooden boxes to stand sulphuric acid without leaking? 2. How may porous earthenware, or that which is not well glazed, be prepared to give the same result?

Ans.—1. Obtain at the provision stores boxes with dovetailed side, remove the bottom and replace it tightly, using copper or brass nails. Soak in boiling paraffine wax. Make a second box, into which the first can be placed. Soak the inside of the second box with paraffine wax, and while both are hot place the first in the second and pour in melted paraffine to fill the space between the two boxes.

2. Heat the ware and apply asphalt in the solid state. A portion will be melted and absorbed. Asphalt may be used in place of paraffine above.

To the Editor of Electrical Review:

Where can I find information to aid me in building a small dynamo to give 50 volts, 1 ampere? STUDENT.

Ans.—We have in preparation a series of articles on the subject of small dynamos.

To the Editor of Electrical Review:

Will goods of a delicate tint become faded by being exposed to the arc light?

J. E. JOHNSON.

Austin, Texas.

ANSWER.—So far as we know, the electric light will not affect colored goods.

In order to render glue insoluble in water, even hot water, it is only necessary when dissolving glue for use, to add a little potassium bichromate to the water, and expose the glued part to the light. The proportion of bichromate will vary with circumstances, but for most purposes about one-fifth of the amount of glue will suffice.

Telephonic News

*** American Bell stock is 219 bid, 220 asked.

*** The Indiana Legislature has adjourned without repealing the telephone law.

*** W. B. Joyce, formerly manager of the telephone exchange at Stillwater, Minn., has accepted a similar position at Fargo.

*** The demand for telephones is still quite general in the United States, and all companies are reporting an increase to their lists of subscribers.

*** Thomas Wallace, of New York, is reported to be in Canada organizing opposition companies to the Bell. If any companies are formed the Wallace telephone will no doubt be used.

*** The Committee on Railroads, to which was referred the two bills introduced in the Michigan Legislature regulating telephone rates, has reported the same adversely, and the bills have been withdrawn.

*** The new telephone building on Cortlandt street, in this city, will be, it is now thought ready for occupancy in May. The Metropolitan Telephone Company will have its offices on the sixth floor, the exchange being located on the eighth.

*** The Central New York Telephone and Telegraph Company has just published a new directory, giving a list of subscribers to the local exchange systems at Canastota, Canton, Carthage, Cooperstown, Gouverneur, Herkimer, Ilion, Little Falls, Norwich, Ogdensburg, Oneida, Oneonta, Potsdam, Richfield Springs, Rome, Utica and Watertown, as well as a list of toll stations, of which there are 335.

*** At the annual meeting of the stockholders of the Bell Telephone Company, of Buffalo, held for the purpose of electing a board of directors for the ensuing year, the following board was unanimously chosen, 4,000 shares of stock being voted upon: Henry Altman, Robert S. Boyd, Joseph Churchyard, Samuel H. Cowles, Edward J. Hall, Edward J. Hall, Jr., James McCredie, Harlow C. Palmer, Sherman S. Rogers, Theodore N. Vail, Henry M. Watson, Wm. H. Watson, John L. Williams. At a meeting of the above board the following officers were chosen for the ensuing year: President, Henry M. Watson; vice president and general manager, E. J. Hall; secretary and treasurer, Harlow C. Palmer.

*** The following is a statement of the earnings, expenses, construction and subscribers of the Erie Telegraph and Telephone Company for the quarter ended Dec. 31, 1886:

Quarter Dec. 31.	1886.
Gross earnings	$137,409 27
Gross expenses	93 296.14
Net earnings	$44 111.13
Construction	8,819.78
Earnings above all disbursements	$35 291.35
Dividend	24,000.00
Surplus	$11,291.35
Previous surplus	41,670.97
Total surplus	$52,962.32
Number subscribers connected Sept. 30, 1886	9,278
Added during the quarter	238
Total number connected Dec. 31, 1886	9,516

We see that the celebrated syndicate suits have all been decided against the Erie Company, and as the costs and attorneys' fees are very large, it is doubtful if they are included in the above report. Some of the stockholders in this company do not enjoy paying the costs of trying private suits out of the company's treasury.

*** The manager of the Oswego, N. Y. telephone exchange, Mr. J. R. Pierce, has resigned, and General Manager Timpson will in future spend a portion of his time in that city looking after the business. The number of subscribers doubled under the management of Mr. Pierce.

*** Worcester, Mass., is giving an Industrial and Electrical Exhibition, which is largely patronized and contains a number of notable exhibits, among which are several practical applications of electricity. The power is all supplied by the Electric Power Company's plant. There are in the engine house two engines, one of 30 and the other of 100 horse power. The first supplies the power for the business on Main street and the latter runs the exhibition. A new dynamo, however, of 60 horse power has been put in, which supplies the electricity used in the exhibition. The old dynamo has 50 horse power. The electricity is conveyed from the dynamos to the motors and thence to shafting, which is in two main parts, one running down the north side of the Exhibition Building, the other along the south side. The shafting on the south is divided into three divisions, and on the north into two. The machines are belted directly from the shafting. There are 11 motors varying from 1 to 10 horse power scattered about.

The Fire-Proofing Secret.

A writer in an English fire paper, which persists in using articles from the *Herald* and crediting them to a defunct paper, says: "The showmen who perform such wonderful feats with fire and announce themselves as 'fire kings' and as being fire-proof, use an ointment made by dissolving two ounces of camphor in four ounces of aqua vitæ, and then adding two ounces of liquid storax and two ounces of quicksilver. Two ounces of hematis, beat into a powder and mixed with the above ingredients, completes the mixture, and when it is rubbed on the hands a red-hot iron may be held in the hands and bent double, or by its use one can safely walk on red-hot irons. If used too often, it discolors the skin." We cannot vouch for this fire-proofing compound, but our readers can make experiments for themselves. It would be a novel idea for the firemen to render themselves fire-proof. — *Fireman's Herald.*

A Telephone Change at Toledo.

Auditor J. J. S. Wilson and Supt. M. J. Carney, of the Central Union Telephone Company, were in Toledo, last week, making a transfer of the office into the hands of Mr. John W. Cherry, who has heretofore been the manager of the Sandusky Exchange. Mr. Frank Graves, the present manager, has resigned to go into the insurance business with Major E. O. Brown, under the firm name of E. O. Brown & Co.

When Mr. Graves took charge four years ago, there were 400 subscribers, and since then the number has been increased to nearly 1,000. The system of operating has been changed twice, the present system being considered one of the best in the country. Mr. Graves has made a very popular manager, and his many friends express the belief that he will reap the same measure of success in his new business.

Mr. John W. Cherry, the new incumbent, is a native of Sandusky, and learned the telephone business under the tutorship of Mr. Graves. He is thoroughly practical and will, no doubt, keep the exchange to that standard inaugurated by Mr. Graves. He has assumed charge, and will move his family to that city at an early date.

*** A. C. Tichenor, of Oakland, Cal., is said to be astounding the natives with the reports of his discovery, by which he extracts powerful currents of electricity from mud and water. Tichenor has evidently been working over the old fable about Edison, which has become so familiar in electrical circles in the East, in which food and raiment were extracted from the same source by means of electricity.

Philadelphia's Electrical Department.

Chief David R. Walker, of the Electrical Department, has submitted his annual report to the Mayor. It is his third and the thirty-first report of the Department.

It speaks of the removal of the Fire Alarm Department to its new quarters in the City Hall, the beginning of a permanent system of underground works, for the introduction of the municipal electrical service, the lighting of the highways by electric lights, supplied with their currents by means of underground wires, and the extension and improvement of the municipal service controlled by the Electrical Department.

In relation to the underground cables it says: The conductors furnished the department by the Brooks (oil system) Company have nearly all proved faulty and of no service to the city.

CITY UNDERGROUND SERVICE.

An appropriation of $2,500 was made to the department to test the feasibility of underground electric light service, and on Wednesday, May 25, 1886, ground was broken at the southeast corner of Broad street and Columbia avenue for the introduction of the first permanent underground service for municipal purposes. The line extended to the Reading Railroad, along Broad street, a distance of 5,200 feet.

A wire used for electric light purposes is attached to the air line at Columbia avenue and extends to the Reading Railroad and return, requiring for the purpose 11,500 feet. Iron posts, extending twenty feet above the sidewalk, were placed at the corners of Montgomery avenue, Berks, Norris, Diamond, Susquehanna avenue, Dauphin, York, Cumberland, the Reading Railroad and Lehigh avenue. This service has worked without failure, the lights not having been extinguished except through a stopping of the machinery or the breaking of the air line, and has demonstrated the entire feasibility of underground service for electric lighting purposes.

"No effort has yet been made," says the Chief, "by the overhead telegraph, telephone and electric light companies to place their wires underground and remove their poles from the streets during the last year. I require all parties owning or controlling telephone, telegraph and electric light lines to make the usual returns to this department, so that if there should be any changes in the course of legislation whereby I would be justified in collecting license charges for poles and wires maintained in the city, as well as those attached to the city poles, I will know how to proceed, and also in order to prevent delay in payment should the suits now pending in the courts be decided in favor of the city. The total returns made for poles, wires, conduits, attachments to city poles and mileage of wire amount to $23,586.50, of which amount $7,149.50 has been paid into the City Treasury, leaving unpaid $16,337, a portion of which is in the hands of the City Solicitor for collection.

"According to the returns made to this Department there were, on December 31, 1886, on the highways of this city, 5,053 poles, exclusive of those along railroad tracks and city poles, being an increase of 231 poles over 1885; four thousand four hundred and ninety miles of telegraph and telephone wire, being an increase of 122 miles; 204 miles of electric light wire, being an increase of 47 miles, and 595 miles of city wire, being an increase of 57 miles, making a total of city and all other wires 5,289 miles, being an increase of 226 miles over the previous year. The increase of poles was mainly due to the extension of the electric light service for lighting the public highway.

"On December 31, 1886, there had been laid underground in the city 472.6 miles of telegraph, telephone and electric light wire, of which the city owns 21.6 miles.

ELECTRIC LIGHTING.

"In the last annual report a suggestion was offered as to the advisability of extending the electric light service to all parts of the city, in connection with which I would add that the lighting of our thoroughfares has reached a point at which I think it would justify the city in establishing its own plants for that purpose; the city, owning the gas and water works, would have the power necessary for the service and would be at little additional expense for that necessary agent; the outlay for conductors, lamps, dynamos and other machinery would be the greatest expense. Its first cost would in a measure be returned to the city by having the amount charged by private companies in excess of the actual cost of production, and also by the increased facilities offered for public lighting. It has become an established fact that wherever the electric light has been introduced great assistance has been given to the police in discharge of their duties, and crime and criminals disappear from its immediate neighborhood. At the close of the last year there were 198 electric lights, and at the close of 1886 there were 354, an increase of 156 over the previous year, maintained by the city for lighting the public highways, at an average cost of 53⅛ cents per night.

"There were extinguished during the year 312 gas and gasoline lamps, of which 285 were by the Philadelphia Gas Works, 26 by the Northern Liberties Gas Works, and one gasoline lamp, making a total of 737 lamps extinguished where the electric light has been introduced.

"From its physical characteristics arc lighting has gradually become used only for the streets and large areas of enclosed space, where it is best adapted for the diffusion of its concentrated beams of light. On the contrary, the incandescent light, by the facility it affords for an equal distribution, is almost exclusively used for indoors. The increasing use of these methods of illuminating and their growing popularity has demanded the special attention of this department, and this duty has been made more imperative by the incidents of the fire on the 27th of December, 1886, at the Temple Theater. At this date there are in use in the city over 4,000 arc lights, including 354 furnished the department under contract for street lighting and nearly 20,000 incandescent lights in use in public and private establishments, factories and residences, and the number is rapidly increasing as the advantages, under certain conditions, become known to the public. The question presented to the department by virtue of the supervision with which it is charged is, What are the sources of danger? The apprehension by the public of danger to life from the arc lighting system, with the current of great intensity necessarily used, and of danger from fire by the multitudinous wires of incandescent installations would be wholly without basis if a uniform method, recognized by law, was established for the inspection of the methods of wiring and insulation. This inspection should be by a competent expert, employed and duly licensed by the department. The Gas Trust, a department of this city, it is well known, does not permit the flow of gas into a service newly introduced into the building until all leakages are detected and stopped under proper safeguards, and in the absence of these lies the danger. The use of steam without proper precaution and by careless and incompetent persons and even the ordinary illuminating gas and coal oils may become sources of as great risk as electricity presents when the well-known electrical laws are not observed.

THE TEMPLE THEATER FIRE

has in its results excited an unreasonable fear, which would be dispelled by a careful reading of the verdict of the jury, which distinctly states that the danger of fire from electric lighting is a minimum, and lays the whole blame upon the reckless way in which the wiring was done.

"The recent International Electrical Exhibition in this city, held in a temporary frame structure filled with inflammable material, with a multiplicity of wires differing in intensity and in close relation to each other, continued to its close without fire or an alarm. The safety of incandescent lighting has proved to be so great that it has led

to neglect of the ordinary rules of precaution, which would not be possible under any other system.

"The following recommendations for incandescent installation are respectfully submitted:

"First—Lamps should not be placed in close proximity to inflammable material. The breaking of a lamp will scarcely ignite inflammable solids, but will ignite inflammable and explosive gaseous mixtures if present.

"Second—Avoid trusting wire jointswithout soldering. Any accidental cause may induce the formation of an arc, which might be avoided if the joint were prevented from shaking loose or opening by soldering.

"Third—Use only uninflammable waterproof insulation for the entire system.

"In the case of paraffine and cotton insulation, the overheating of the wire by too heavy a current will melt the insulation for its whole length, and on ignition it acts like a taper and flame conductor. If the insulating wire is not water-proof, there is the danger of a circuit from rain or water or the condensation of steam.

"Fourth—The use of safety plugs of standard proportion, to act as cut-offs if currents become of too great intensity.

"Fifth—Installations to be made entirely by companies, which should assume responsibility for their employes.

"Sixth—Issuing of a permit to use a current only after the department has inspected the covering.

These are well-known rules to experts in electrical matter, but not as familiar to the general public. The very high potential of the series arc system demands that these wires should be kept separate from all others and requires precautions in insulation. The well-known fact of the danger attendant upon the handling of dead currents has acted to prevent loss of life on the part of the general public, but accidents to the employes of the companies do occasionally happen because of neglect incidental to familiarity."

Aluminum Steel.

Messrs. S. French and B. M. Plumb, of 36 Lombard street, E. C., London, the European agents of the Cowles Electric Smelting and Aluminum Company, of Cleveland, Ohio, are showing two interesting samples to illustrate the beneficial effects of the addition of small quantities of aluminum to steel. Each specimen consists of a bar of iron, and a bar of Siemens-Martin basic steel welded side by side and broken off. In one specimen, however, the steel contains one-fifth of one per cent. of aluminum, while in the other the metal is of the ordinary quality. In the latter case the position of the weld is clearly visible, there being a clear line between the crystalline structure of the iron and the fine grain of the steel. But in the former sample no such line is to be seen, and the characteristics of the steel appear to extend far into the iron, rendering it impossible to tell by the appearance were one ends and the other begins. The same firm have also a forged bar of aluminum bronze, containing five per cent. of aluminum, which has broken in the testing machine at a strain of 36 tons per square inch of original section, and with 60 per cent. elongation. A bar of this metal, forged, bent, and broken in company with a similar bar of Siemens-Martin basic steel, exhibited characteristics identical in every respect except color.

* * The board of directors of the Washington and Georgetown Railroad Company, (Washington, D. C.) has adopted a resolution directing the appointment of a committee "for the purpose of taking under advisement all questions looking to the future requirements of the company, and that they be directed to visit the various cities where cable roads are in operation, and that they solicit correspondence in regard to the various kinds of motive power used on street railroads." The committee will also investigate electricity as a motive power.

OUR PHILADELPHIA LETTER.

To the Editor of Electrical Review:

The Girard Trust have finally concluded to light the Girard College grounds with arc lights, the contract having been awarded at $10,750 to the Fort Wayne Jenney Company. Seven towers, each 125 feet high, will be used, each tower carrying five or six lights; all the wiring to be carried underground. The Jenney Company have also received a conditional order from Strawbridge & Clothier; they make a four months' run with 30 lights; if satisfactory the entire store is to be lighted with 200 lights. The action of Philadelphia Councils in granting certain privileges to the Penn Electric Company has called forth a vigorous protest from the Keystone (Westinghouse system) Company, which was presented to the city councils. Its result is a question for our city Solons to settle.

Darlington, Runk & Co. are about increasing their Edison plant to double its present capacity; an additional Armington & Sims engine is to be used. Their wholesale department will be lighted with an arc system.

From a letter just received I am informed that Jas. S. Humbird has signed with the Mobile (Ala.) Edison Company to install a large incandescent station in that city, and that Mr. Humbird's representation of the Edison Company has been largely extended, taking in several Western States. He is to locate in Chicago. If he captures the Western cities in the same ratio that he has in Pennsylvania, the Edison business will get a boom in the West.

The Northern Electric Light Company are rapidly covering the northeastern section of the city. They are doing a good business in commercial and street lighting, and contemplate adding 200 horse power more to their station; they use the Thomson-Houston system exclusively.

Messrs. Walker & Kepler, Philadelphia, representatives of the Edison Company, have about completed a Storage Central Station at Chelten Hills, near Philadelphia, supplying several houses. The accumulator is charged from an old style Edison dynamo L size; running 15 hours supplies the accumulator for one week, giving current enough for about four hundred 16 candle power lamps. They have also installed two Edison dynamos at Wm. Wharton, Jr. & Co's Works to run an experimental electric railway, besides having just closed a central station contract for Downingtown, Pa.

The La Roche Electric Company have begun operations at their new factory, 810 Arch street, for the manufacture of certain electrical appliances; besides manufacturing they propose doing a limited amount of incandescent and motor work. A combination of our various arc companies has been formed for street and commercial lighting, but this is as yet "sub rosa;" you shall hear more of it later.

Chief of the Electrical Department of Philadelphia, David R. Walker, has rendered his third annual report to the city, in which he points out the feasibility of underground electric light service, and shows that the form and character of the conduit is of very little importance where lead covered wires are used. The city's underground work is simply a plank box in which the lead-covered wires and cables are laid, the box being afterwards filled with pitch. This has served for experimental purposes on North Broad street for over a year. The cable used for telephone and telegraph purposes is made of six wires, each of which is insulated and covered with lead and laid together in such a way in the cable as to break that parallelism which favors disturbing "induction." He is strongly predisposed towards the city owning the various underground conduits, and offers a very good suggestion; if the city could not find the means to go into the business directly, it might provide for an exemption of taxation on the use of the streets for a definite number of years, on condition that the conduit should then become the property of the city and be at all times subject to the city's control.

Mr. Walker's report [which we publish in full elsewhere.—EDS. REVIEW] contains a number of excellent recommendations with the exception of the 6th, which places a department or a single individual in a position to act as judge of work which he may know very little about. Mr. McDeavitt (a very competent and careful man) inspector of electrical work for the Insurance Association, has certain well defined rules that must be observed. Let Mr. Walker adopt these rules and make his department an unpolitical one and without favoritism, appoint an inspector or a corps of inspectors of the same calibre as Mr. McDeavitt and there would be less cheap and dangerous work erected. J.

PHILADELPHIA, March 19, 1887.

The Cable Tugging to Get Away, and Operators Turning Pale.

The alphabet is badly frightened at the prospect of war in Europe.—*Minneapolis Tribune.*

The Hess Alarm at Buffalo.

Proprietor Stafford, of the Richmond Hotel, Buffalo, says that had it not been for the electric alarm, which worked so admirably, the loss of life would have been much greater. The alarm, which is known as the Hess, is owned by the Standard Electrical Works, of Cincinnati, and was put in by Schmidt, Kaelber & Co., of Rochester. The final test, a result of some later changes, was made of the alarm at 9 o'clock of the night of the fire, and at 3.30 the fire broke out, the alarm was turned on and every room was signaled. The Hess guest call and fire alarm will undoubtedly be in demand for such work hereafter. It is already in use in a number of hotels.

New Enterprises in the South.

CHATTANOOGA, TENN., Feb. 18.—The weekly report to *The Tradesman* of new enterprises in the South shows that among the leading new industries reported were the following: Electrical Appliance Company, Baltimore, with $5,000,000 capital; Boyden Power Brake Company, Baltimore, $500,000 capital; five cotton mills—two at Decatur, Ala., one at Eufala, Ala., one at Gainesville, Ga., and one at Gainsville, Fla.; two electric light works—one at Decatur, Ala., and one at Richmond, Va.; three large flouring mills—one each at Houston, Tex., Alamo, Tenn., and Dublin, Va.; Fayetteville, Tenn., Coal and Iron Company, with $1,500,000 capital; four marble quarries, two at Strawberry Plains, Tenn., one at Rome, Ga., and one at Plantersville, Ala.; a cotton-seed oil mill at Vicksburg; a fifty-ton charcoal furnace and 100 ovens at Florence, Ala.; two tobacco factories—one each at Bristol and Bloomingdale, Tenn.; a tack factory at Chattanooga; a woolen factory at Mossy Creek, Tenn.; 200 coke ovens at Chattanooga; also a bed lounge factory and cutlery works at Sag City. Six water companies were organized in the South as follows: At Laville, Fla.; Huntsville, Ala.; Calero, Ala. Spartanburg, S. C.; Kyle, Tex.; and Farmille, Va. Nineteen railroad companies were organized during the week—eight in Alabama, one in Kentucky, one in Georgia, three in Tennessee, one in North Carolina, two in South Carolina, two in Texas and one in Virginia. Chattanooga real estate was more active last week than ever, and actual transfers exceed $2,000,000 in amount of consideration for the week.

* * We have received, with the compliments of the author, "Telegraphing to and from Railway Trains," and "Duplex Telephony," being copies of papers read before the Canadian Institute in 1886, by Dr. A. M. Rosebrugh. Both these topics are discussed interestingly and at length.

TELEGRAPHIC

.... Albanyites are well pleased with their new fire alarm system. All the work was done under the supervision of Mr. William Cull, of that city.

.... A contract has been let to the Johnstown Girder Rail Company, of Johnstown, Pa., by the Allegheny Electric Railway Company, Allegheny, Pa., for about 400 tons of steel rails, to be delivered early in April.

.... The citizens of Rochester, N. Y., have had another writing telegraph instrument presented to them for experiment. If they can discover anything that will equal the telephone, we hope they will let us know real soon.

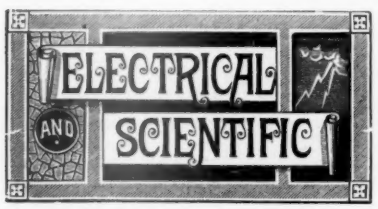
.... President Partridge, of the Buffalo Common Council, has appointed Aldermen Scheu, Callahan, Kennedy, Richardson and Doyle to visit New York, Philadelphia and Brooklyn and report upon the best conduit system for telegraph and other wires.

.... The Western Union messenger boys of Philadelphia went on a strike last week. This is the same strike they went on, or rather started to go on, over a year ago, and great surprise is felt that they should have reached it so soon. It is believed they have been walking in their sleep.—*R. J. Burdette.*

.... Mr. R. B. Gemmell, superintendent of the Atchison, Topeka and Santa Fe telegraph lines, has just completed his report for the year 1886, which shows that during the year there were 850 miles of telegraph wire put up by the Santa Fe. During the present year his men have been at work on the Indian Territory line and the Ellinwood line, and 325 miles have already been put up. Mr. Gemmell will start a force at work at once on the A., T. & S. F. telegraph line from Kansas to Chicago, taking the same route as the Chicago line of the A., T. & S. F. road will take. This telegraph line, which will be 454 miles in length, will probably be completed before May 1. It crosses the Missouri River at Sibley, where it will be necessary to build a cable across the river; it crosses the Mississippi River at Fort Madison, Iowa.

.... A new application of electricity is credited to Mr. James Semple, of Cincinnati, corresponding secretary of the National Association of Master Plumbers. It is in the discharge of water for flushing purposes from the tank, which, it is claimed, can be done without any reference to the location of the tank, and which operation is effected in much the same manner as bell-ringing. The plan as described involves the attachment of the valve of the flushing tank to one end of a lever which has an electro-magnet near the other end, while an electric button is placed near the closet. When this button is pressed the circuit is closed, and the lever being attracted by the magnet, the valve is open and the water is discharged. A small battery is used for the purpose, but where electric bells are already in use the batteries can be still further utilized in this direction.

.... It is probable that had Mr. Beecher understood telegraphy he might have communicated with his family after the stroke which rendered him speechless. The contraction of the fingers of his right hand would seem to indicate the possibility that he was conscious, and had he known how to regulate those contractions in the formation of telegraphic signals he could have thus conveyed his thoughts while otherwise utterly powerless. I knew of a case some years ago, says a correspondent, in which a telegrapher thus communicated with me when we supposed him unconscious. In holding his hand I felt a faint twitching of the muscles of his fingers and recognized telegraphic signals thus made. He was perfectly conscious of what was passing around him, but unable to speak or move a muscle, except the faint contraction of the finger muscles as described. It was a remarkable case and unparalleled so far as I know.



* * The old Government telegraph line from Deadwood to Ft. Meade, 18 miles long, was sold at auction to the Black Hills Telephone Company for $250. The Western Union bid $200.

* * The stockholders of the Colonial Beach Improvement Company are about to make a contract for the construction of a telegraph line from the beach to Fredericksburg. The bids range from $4,000 to $5,500.

* * The People's Electric Light Company, of Trenton, N. J., seem to be doing a large business; they have recently purchased another 65 light dynamo and lamps of the Brush-Swan Company. They are now running 275 arc lights.

* * Senator Cullom, at the next session of Congress, will introduce a bill similar to the Inter-State Commerce bill regulating the telegraph system. The Senator is not inclined to the opinion that the telegraph service should be controlled by the Government, but that the tariffs should be regulated.

* * Some one ought to devise means, well says the *American Machinist*, for improving ventilation in machine shops. It is a fact that the average in this respect is phenomenally low. It is a matter of as much importance to owners as to workmen. In a machine shop, especially where a good deal of cast-iron is worked, there is a necessity for very frequent change of air, while the average arrangement is for no change at all, except by accident. No man can do a good day's work in impure atmosphere, laden with solid matter which he is obliged to breathe, if he breathes at all. A good way to increase the output of many shops, as well as to improve the quality, is to improve the ventilation.

* * Some time ago an inventor who was experimenting with a method of drawing electricity, not from a cat's back, but from the wings of the wind, had made to order a lot of connectors for No. 16 wire; as it happened, the holes for the wire were not bored through, but where the two met there was a slight opening made by the point of the drill. In a few days the would-be transcender of Faraday, Volta, Ampere, etc., returned and complained that the hole through the connectors was not large enough to carry as much current as a No. 16 copper wire. "What did you do?" was asked of the manufacturer. "Oh, I drilled them through for him. I could not afford to give $25 worth of instruction to save 5 cents worth of unnecessary work."

* * The annual meeting of the Manchester (N. H.) Electric Light Company was held last week. At the close of business December 31, 1886, the assets of the company were $79,889.42. The capital stock is $60,000 and the indebtedness $19,880.06, making a total indebtedness of $79,880.06. This leaves assets over all liabilities of $9 36. The expenses incurred in erecting a new building were as follows: For land, $7,900; building, $17,200; steam plant, piping, fitting, etc., $17,000; dynamos, $12,800; lines, wire, etc, $13,100; sundries, $7,000. There has been paid out during the year for labor $5,697.28, and the total expenses have been $10,638.85. The current receipts have been $10.516.33. During the year there has been maintained from 66 to 79 arc lights, exclusive of those used in the station, and 248 incandescent lights. There has been a total of 23,121 light nights of arc lights. The officers elected were: President, Hon. P. C. Cheney, of Manchester; Vice-President, Hon. James A. Weston, of Manchester; Clerk, Col. Jos. W. Hildreth, of Manchester; Treasurer, Andrew Robeson, of Boston.

As to Who First Proposed to Apply Electric Heaters to Railway Cars.

To the Editor of Electricol Review:

In the issue of the REVIEW of March 19th, is a letter from Dr. D. Tommasi, of Paris, France, in which he claims to be the originator of the idea of "applying the heat developed in an electric circuit of high resistance to the warming of railway cars," and quotes a passage from the *Moniteur Industriel* of December 25, 1884, in substantiation of his priority.

In justice to myself as an American inventor, I have to say that in the patent issued to me, bearing date of March 23, 1869, for an "improvement in electric heating," the drawing attached to it shows how the device might be applied "for the warming of railway cars."

Moreover, in *Van Nostrand's Engineering Magazine* for September of the same year, is an article written by myself, in which the invention is fully described, the condition of its being applied to the warming of railway cars depending on the practicability of utilizing the axle of a car for operating a "magneto-electric machine," this being several years in advance of the invention of Gramme, and of the afterwards splendid perfection of the dynamo machine.

I will also take occasion to say that a model of my electric heater was carried to France by Mon. C. F. Pardigon, a French gentleman of high scientific and literary attainments, just before the breaking out of the Franco-Prussian war; that is to say in 1870 or '71. M. Pardigon was a graduate of the College de France, and he proposed to lay the invention before the faculty of that institution; but the war coming on so soon after his arrival, the project was abandoned, and when he returned to this country he left the model in France.

The fact is, no electric heater at that time was practical, owing to the fact that the dynamo machine had not been invented; and when I exhibited mine in operation at Philadelphia at the International Electrical Exhibition in September, 1884, it was admitted on all sides that it was at least fifteen years in advance of the times.

In conclusion, permit me to say that having obtained a new patent for a very important improvement in my electric heater, I have good grounds for hoping that in the near future the utilization of electric heat for the warming of railway cars will be *un fait accompli*.

Very respectfully,

W. LEIGH BARTON.

Richmond, Va., March 1887.

The B. and O. Telegraph.

BALTIMORE, MD., March 15.—A reporter had an interview with President D. H. Bates, of the Baltimore and Ohio Telegraph Company, this afternoon, with regard to the financial condition and stability of that concern. President Bates claims that the Baltimore and Ohio Telegraph is not losing money, as stated by certain New York newspapers. He said that they were doing a very large business, and were making constant additions and extensions to the system.

"The statements that we are falling behind and have lost many thousands of dollars per month," continued Mr. Bates, "have been persistently put forth by the Western Union officials, who could only guess at such things, without having any actual knowledge. Since 1884 our mileage has increased three times, our revenue four and a half times, and our traffic nearly seven times. We are to-day handling a larger gross traffic than that handled by the Western Union in 1869. But at that time the mileage of the Western Union was double what ours now is, and it then cost them three times as much to perform the same service as it now costs us. Within the past three years the net revenue of our chief competitor has fallen from $6,000,000 compared with the three years immediately preceding, while, on the other hand, it has expended during the first-named period for additional wires and plant nearly as much as the whole cost of the Baltimore and Ohio Telegraph system beyond the line of the Baltimore and Ohio Railroad, and the fixed charges of our rival have enormously increased, reaching now about $60,000,000.

The Baltimore and Ohio Telegraph Company last year paid over to the Baltimore and Ohio Railroad Company a large sum as clear profit on the fiscal year's operations, besides paying for all the batteries, instruments and supplies used by the Baltimore and Ohio Railroad for its train service. The youngest child of the oldest railroad corporation in the United States, with no fixed charges, and with what I believe to be the best service and most capable staff in the world, can, therefore, be considered as solid and substantial enough to stand alone."

The Position of Copper.

The unsatisfactory condition of the market for ingot and other forms of crude copper is exciting a good deal of comment in the trade, especially as for some time past prices have been on the decline and do not appear to have touched bottom. So far as large sales are concerned, trade just now is almost at a stand—dealers and consumers having very generally covered their requirements up to the 1st of April by the large pool contracts negotiated with the Calumet and Hecla Mining Company at the commencement of the year—while since then several other Lake Superior mining companies have sold some portion of their product at the same price that was then established. Under ordinary circumstances the inactivity of the market would not be of special significance, but recent events seem to foreshadow another change in prices, which is not altogether unlikely to be a further decline. To fully appreciate the present condition of affairs it is necessary to go back to last autumn when the advance to 12 cents took place. Previous to that event a great deal was said as to the extensive reduction that had taken place in the production of the Montana and Arizona mines, which it was claimed, in connection with increased consumption, had so far overcome the depressing influence of over-supply, that the industry was once more in a healthy condition. These stories were accepted and believed, aided as they were by a bull speculative movement that gradually urged prices upward, and culminated in the Calumet and Hecla sale at 12 cents. The next move was the more recent sale of lake ingot by the same company at 11 cents, a drop that was as sudden as it was unexpected, and which sent consternation into the camp of those who had benefited most by the previous advance. The Calumet and Hecla no doubt endeavored to market its product at the best obtainable price, and its failure to obtain more than 11 cents was due to the fact that the available supply was much larger than was generally believed, for not only had the production of the lake mines been increased, but the falling off in the output of the Montana and Arizona mines was very much less than was supposed.

Then again, the exports last year were little more than half what they had been the previous, the shipments of ingots and bars amounting to only 10,504,000 pounds, against 36,222,000 in 1885. It is impossible to believe that consumption has increased in this country to an extent that would more than balance this difference, and at the same time absorb an increased production. In the light of recent events, therefore, it would seem as though the principal lake mining company had become convinced that the advance to 12 cents was a mistake, and had discovered that, by its action at that time, it had been practically made to hold the umbrella while the smaller companies at the West found a market for their product at a price they never could have obtained otherwise, and had determined to do what it could towards undoing the errors of the past. Furthermore, it seems that so far as the quantity sold last January was concerned, the sale was a disappointment to the Calumet and Hecla, and hence the rumors recently current that the next sale will establish another cut, which, if realized, will be a much more serious matter to the Western mines than to this powerful corporation that can afford to sell at a very much lower price and yet make a good profit for its shareholders. The consumption of copper has no doubt increased in this country during the past twelve months very materially, but it has not yet caught up with production, while so important a drying up of the foreign outlet, with values here much above the parity of foreign markets, the depressing influences of excessive supplies are weighing down the market, and must result in sales at somewhere near the basis at which we started last autumn.—*Shipping List.*

PERSONAL NOTES.

Mr. H. P. Hungerford, of the Electrical Supply Company, is again at his post in this city, after a severe illness of several weeks.

A telegram from Messrs. Edison and Gilliland states that they are enjoying good health at their Florida home, at Ft. Meyers. They will return in the spring.

Major J. M. Brown, of Washington, D. C., the well-known representative of the American Bell Company, gladdened his New York friends with a brief visit last week.

There is one humorous lecturer connected with the New York electrical fraternity, and at the celebration of the Electric Club's first anniversary he is to make the greatest effort of his life.

Col. Geo. L. Beetle, of the Western Electric Company, has been confined to his home in Brooklyn for a week past, but is now recovering, and will soon be welcomed among his friends again.

The only electrical man called on the Cleary jury was Col. M. W. Goodyear, of Greeley & Co. Fortunately for his peace of mind the jury box was filled before he was reached, and he escaped a happy man.

Mr. Henry Hine's Electric Club paper on "Electricity and Insurance" has been highly commended and quoted from by the foreign electrical and scientific press. It was an able article by a bright and practical young man.

Mr. T. N. Vail is taking great interest in the electrical accumulator business, and may decide to more effectually sever his telephone connections, and devote the greater part of his time to this interesting branch of electrical work.

Mr. W. A. Jackson, of Detroit, has been in the city for several days, looking into the question of storage batteries. His company, the Detroit Electrical Works, is doing an extensive business with the new electric motor invented by Superintendent Fisher.

Mr. H. C. Davis was greeted with a list of seven plants when he first became interested in the Sawyer-Man system of electric lighting, a little over one year ago. To-day the company has difficulty in filling orders, and has a very large list of plants, and is represented in all parts of the country.

It is among the probabilities that Mr. Geo. L. Phillips, now of Chicago, and president of the Central Union Telephone Company, may accept an Eastern offer of high responsibility in telephone circles, and make his future residence not very far from New York city. We wish to remark that he will be welcome.

H. B. Thayer, manager of the Western Electric Company, of this city, is recognized as possessing three very commendable qualifications: he is one of the most industrious, one of the best-looking and one of the most popular men in the electrical business. (If he cannot get a wife now, no hope remains.)

Col. Jno B. Powell, general manager of the Brush-Swan Company of New England, though suffering from a severe cold, can congratulate himself on securing a number of extensive electric light contracts recently. The plant of 1,750 incandescent lights which goes into the Elmira StateReformatory should certainly please the most ambitious general manager.

A number of the friends of Messrs. W. D. Sargent and E. J. Hall, Jr., visited the Wall street pier last Thursday, to see these two well-known telephone gentlemen off for a month's vacation at Nassau. There were a number of ladies present. Among the gentlemen were Messrs. Cutler, Goodyear, Jackson (of Detroit), Carson, Dutton, Downs, Thompson, Reiley, Doolittle, Storke and others.

An Electric Light Drama.

A short while ago a lad in an Ohio theater gallery, where an incandescent group of lamps was run on an arc circuit, got hold of something which sent him spinning into the arms of a bystander, with the remark:

"Saay, mister, the 'lectricity's busted," when he almost immediately expired from the shock received.

Now, it isn't at all impossible that the "busting" of the electricity in this case may be something which the learned gentleman may throw some light upon. The circuit alluded to has ceased to exist, by special request of the authorities.

The class of experimenters represented by this child of the streets is rapidly growing in numbers, and it has been proposed that someone shall write a drama for their benefit. Somebody suggested that a proper name for such a "skit" would be: "Experience, or: ? and Consequences." Of course, everyone knows what ? is. It's a little crooked thing that asks questions, and tries to find out things.

The properties required for the sketch are readily procured. A man or boy who accepts the title role—?—a practical dynamo in action—several electric lights—and one Ananias.

In the first act, the scene being the dynamo room, the dialogue turns upon the danger of electric light. ? is told of the simplicity and safety of "our system," and the two join in a jolly song, with a refrain:

"It never won't hurt,
It never won't hurt;
Won't never hurt nobody, no!"

The second, an out-of-door scene, represents a fire, the glaring flame of which is reflected from the half naked wires. In the front ground ? discovered climbing a pole, with a hatchet to cut the harmless wire. The curtain and ? come down together.

The third shows the dynamo room in darkness. Opening chorus by an unseen choir:

"One more fellow,
One more fellow has crossed,
One more fellow
Has crossed the river to-day."

ANANIAS (as the scene gradually lights up): "What is that? Who sings this doleful ditty, and what is the bumping and fluttering I hear? Speak, or fear *me* power!" (hoss power).

CHORUS:

It is we, good Ananias,
Here, above upon the ceiling;
All the fluttering that you hear,
That's our wings.
And the bumping of our heads,
That's the bumps.

We've nothing to sit on,
And that is the why
We're constantly flying,
Our wings flapping high.
And good Ananias,
Recruit us some more.

ANANIAS.—Away! avast! etc., etc.

Then the remaining character should experience a change of heart and quit the business—advertise as an electrical engineer—build a dynamo or a motor, and, having sold out, settle in Canada, a poor, but dishonest remnant of his former self.

It would seem as if there were bones enough here to skeletonize a sketch. Other characters could be introduced. There's the queen of the tub who took the nice white wire for a clothes line, and danced all over a metal roof while she hanged out her washing. And the little boy who wondered if the paint on a water pail was good insulation, and found he was mistaken when he held one hand in the water and "just teched" the wire with the other; perhaps, too, the farmer's horse that was tied to an electric light pole and executed a lot of fancy steps immediately after a rain storm came up; and the owner, who assisted in the jolly quickstep when he came to unhitch him; and—but that's plenty for one play, though there are numberless other characters which may be taken from life.

Points on Profits.

"Profits in central station lighting!" said my friend Stubbs, a mechanical engineer of the old school, "it's a wonder that some stations pay", "How's that?" I meekly asked. "I'll tell you, my boy, an electric light station sells power either for lamps or motors. If it is not paid for all of its lamps the profits will not be large. Two years ago I was in a central station in the East where they wasted the power of 40 incandescent lights on each machine." "I should think the machine would have heated." "It did, in the bearings, and there was a ⅛ inch stream of water running on each dynamo bearing and the pipe fittings for the water supply were not temporary. No wonder the coal pile dwindled and the water bill was high. I was told the other day that in another station a man was employed to feed broken ice to the bearings. I think that the stockholders will need some of the same on their heads when they look for their dividends." Bidding Stubbs good-bye I called on Voalt, a practical installer of electric light plants. I asked him if he would tell me some points in which the management of electrical machinery could be improved. "Yes. In arc lighting, the discount on bill, owing to imperfect burning of lights, far exceeds the difference in cost between good and poor carbons. Commutators are worn out by filing. I have known of men who run their dynamos at slow speed and apply a coarse file. The commutators get out of true and have to be turned. The resistance of four contacts in offices in the line wire is sometimes equal to 6 or 7 lamps on a 12 mile circuit of 50 arc lamps."

F. M. G.

Lightning and the Cocoanut.

Sir Emerson Tennent long ago called attention to the power of the cocoanut palm to conduct lightning, and the subject is again called up by a Ceylon paper. Five hundred of these trees were struck on a single plantation during a succession of thunder storms in April, 1869. But the trees suffer terribly from the effects, for, however slightly they may be touched, they are sure to die. Even if only the edges of the leaves are singed, or only a few of them turned brown, the tree will in the end wither gradually and perish.—*Chicago Times.*

—— The Edison Electric Light Company of St. Paul, Minn., has been in successful operation for nearly a month. Already they have a load of 3,000 lamps on a capacity of 10,000. All the electrical work was done by the Marr Construction Company of Harrisburg, Pa., under the personal supervision of H. M. Doubleday, Superintendent, and T. Spencer, electrician. Their work is a model of neatness and good workmanship. The five Buckeye engines (150 horse power), dynamos and electrical apparatus are all arranged with a view to economy in space and convenience. The Marr Company spare no pains in doing their work first-class and deserve the success they meet with.

—— In the New York Legislature they purpose using electricty as a substitute for self-adjusting hemp cravats on particular occasions of sudden death.

Seriously, this would be a decidedly long step in advance. If we must execute criminals for certain crimes for the good of community, the more quietly, and privately, as well as painlessly it is done the better. The morals of community are not improved by the row and rumpus, the excitement and sensation of a hanging bee.

A curious result of the most notable hanging ever known at Buffalo—it was in the olden time, when elections lasted three days, and hangings were public—that of the three Thayers, was the next subsequent death in the same manner.

A man named Holt, from Rochester, came to Buffalo to witness the execution of the Thayers, and had a booth on the ground. He was so well pleased with the town, and with the hanging as well, that he settled in Buffalo, killed his wife with a shoe hammer, and was the next victim of the hangman's rope.

—— The Electric Light Company recently formed at Waverly, N. Y., has adopted the Brush-Swan system.

—— The composition room of the Mobile *Register* is lighted by the Thomson-Houston arc light, and this gives great satisfaction to the compositors.

—— At Brunswick, Me., on the 10th inst., the streets and several large stores were brilliantly lighted for the first time by the Brush-Swan Company, of New England.

—— The Charlestown Gas and Electric Light Company have decided to enlarge their works. They have ordered another boiler to be set with the Jarvis furnace so as to burn coke screening for fuel. They have also ordered the second Armington & Sims Company engine. The contract for this increased plant has been awarded to the Jarvis Engineering Company.

—— The Thomson-Houston system has a plant in Charlotte, N. C., to supply the city with arc lights. The plant now furnishes seventy-five lights of 2,000 candle power each, for lighting the streets. The plant is worth $20,000, and is under the management of Mr. P. Burbank. The company, with its present machinery, has a capacity of ninety arc lights, and runs the incandescent light from the same circuit.

—— The Brooklyn Electric Light and Power Company, of Brooklyn, has been incorporated at Albany with a capital of $100,000. The object is the applying and selling of light, heat and power, generated by means of electricity, steam and other forces for practical service, for lighting, heating, power, and other uses, for streets, houses, etc., in Brooklyn. The trustees are Noah L. Cocheu, Richard G. Phelps, and William Palmer, all of Brooklyn, and James H. Hurst and Foster Black, of New York.

—— The New England Butt Company, of Providence, R. I., is most extensively engaged in the manufacture of braiders for covering all kinds of wire. Among electrical houses these braiders stand at the head, and the constant and increasing demand not only proves the excellent work of the Butt Company, but is an indication of the rapidly growing business of the makers of electrical wire. The foreign business of the Butt Company is particularly large, a recent order being filled for Japan, the representative of a company in that country being greatly pleased with the fine work done by these braiders.

—— Do the people of Millville, N. J., want electric lights? was the question decisively settled by a recent election. The First, Second and Fourth wards gave majorities for the men on the ticket for Council who were in favor of the light, of nearly two to one. Mr. Howell, the champion of the anti-electric light, and who made it an issue at the polls, was badly beaten and the vote in the other two wards named was so largely in favor of the light that there is now no mistaking the voice of the people. The vote in the Second and Fourth wards was light, being only 250 in the Second and 249 in the Fourth, while the registration in these wards was over 400, but First and Third wards the vote was as large as usual. In the Third the light was not so much an issue, as it was not known the exact position which the candidates occupied upon the question. The Millville Schuyler Electric Light Company, Stephen Holbrooke, president, is to be congratulated. The Millville *News* of March 1 very properly remarks: "Keep it before the people, that the city of Millville should not turn the cold shoulder to the Electric Light Company after encouraging it to invest their money here. Keep it before the people, that the taxpayers who live outside of the main thoroughfares are entitled to the electric light. Keep it before the people, that the city well lighted all night is a better protection to property than double the police force. Keep it before the people, that such improvements in the city increase the value of property and make the town attractive to strangers seeking investment for capital."

ELECTRIC LIGHT NEWS

—— Petersburgh, Va., is arranging to have its streets lighted by electricity, and will use the Thomson-Houston system.

—— A company at Sheffield, Ala., has contracted with the Westinghouse Electric Company, of Pittsburgh, to have erected an electric light plant.

—— Contract for lighting the Elmira State Reformatory and grounds with 1,750 incandescent and 30 arc lights has been secured by the Brush-Swan Company, of New England.

—— The City Gas Company, of Burlington, Vt., and the Winsted Gas Light Company, of Connecticut, have recently purchased the Brush-Swan system, and are furnishing their patrons with this improved illuminant.

—— The Tokio (Japan) Electric Light Company has purchased a number of the Little-McDonald cut-outs, which will be shipped at once. The company is represented in the United States by J. Fujioka, who was an interested visitor at the last electric light convention.

—— The Fulton Street New York Electric Railway have contracted for their power plant, consisting of a 100 horse power Armington & Sims engine and tubular boilers, set with Jarvis furnace to burn screenings for fuel. The Knight-Bentley system of motors and underground conductors will be used.

—— The New York Central Railway is running a car regularly between New York city and Albany, which is lighted by the Julien storage battery. The officials of the road are said to be greatly pleased with this new method of illuminating their cars, and are considering the proposition of lighting all their cars with the storage battery.

—— The Edison Electric Illuminating Company, of Birmingham, Ala., was organized December, 1886. Leigh Carroll, president; Stanhope Jones, vice-president. Capital stock, $75,000. Capacity, 2,400 lights. The company will erect two-story brick central lighting station for supplying light and power. Plant will be completed May 15, 1887.

—— The annual meeting of the Fall River (Mass.) Electric Lighting Company was held last week, and the following officers for the ensuing year were elected: President, Azariah S. Tripp; Clerk and Treasurer, F. O. Dodge; Directors, A. S. Tripp, F. S. Stevens, John D. Flint, Marsden J. Perry, Welcome H. Hathaway, William B. Hosmer, Frederick O. Dodge.

—— The Fayetteville (N. C.) Brush Electric Light and Motor Power Company was organized last week, and an order made for a plant of 43 arc light capacity. It is to be run by water power, which has been leased for the purpose. Capital, $10,000. Officers are: A. A. McKethan, Jr., president; Henry W. Lilly, secretary and treasurer; Jas. D. McNeill, superintendent; Neill W. Ray, attorney.

—— There are five electric headlights in use on the Cleveland, Akron & Columbus Railway, which the president of the road declares make an annual saving to the company of not less than $50,000, probably a good deal more, by preventing accidents. The gentleman said that the lights could be seen at night seven miles, if objects did not obstruct vision. Numerous incidents were related. An engineer saw at night, by aid of the light and reflector, a horse on a bridge a mile away. The narrator had read a newspaper at night, unbelievable as it seemed, by aid of the light nearly or quite three miles away. An engineer who could not see a tie or other obstruction on the track half or three-quarters of a mile away by an electric headlight had no business on a locomotive. An electric headlight and apparatus costs about $400. The little dynamo is driven by an independent little engine on the boiler of the locomotive, back of the sand dome.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MARCH 15, 1887.

359,243 Apparatus for producing stage effects; Greer W. Davis, New Albany, Ind., assignor of one-half to John H. Stotsenburg, same place.

359,248 Positive pole plate for secondary batteries or accumulators; Stefan Farbaky and Stefan Schenek, Schemnitz, Austria-Hungary.

359,260 Combined push button and thermostat; Frederic Keffer and John A. McDowell, Columbus, Ohio.

359,303 Fluid pressure motor; George Westinghouse, Jr., Pittsburgh, Pa.

359,306 Return attachment for telephone toll collectors; 359,307, Telephone register; and 359,308, Telephone register; Charles Wittenberg, Indianapolis, Ind., assignor to Edward G. Cornelius, same place.

359,309 Electric bell; Frank B. Wood, New York, N. Y., assignor to the New Haven Clock Company, New Haven, Ct.

359,313 Electric torpedo boat; Henry M. Bennett, Bournemouth, county of Hants, England.

359,328 Electric lamp; Carl Seel, Charlottenburg, Prussia, Germany.

359,338 Apparatus for testing electric circuits; Allen D. Wheeler, Hyde Park, Mass., assignor to the Automatic Fire Alarm Association, Portland, Maine.

359,356 Telephone switch; Charles A. Hitchcock, North East, Pa., assignor of three-fourths to Wm. Burnley, same place; Samuel A. Davenport, Erie; and Lewis F. Watson, Warren, Pa.

359,371 Railway crossing alarm; Sterling P. Van Nort, Manchester, Mo.

359,392 Electrical apparatus for regulating temperature; Chas. W. Johnson, Holyoke, Mass.

359,414 Circular loom; George Wasserman, Aussersihl, Zurich, Switzerland.

359,429 Electric motor; Ernest F. Clark, New York, N. Y., assignor of part to Ann Eliza Applegate and James H. Seymour, both of same place.

359,456 Carrier for electro-pneumatic dispatch tube systems; Jas. F. McLaughlin, Philadelphia, Pa.

359,492 Telephone cabinet; Charles Balloch, New York, N. Y.

359,512 Railway signal; Malcom W. Long, Harrisburg, Pa.

359,540 Electrical pneumatic dispatch tube; Jas. F. McLaughlin, Philadelphia, Pa.

359,552 Electric igniter for gas engines; Norman C. Bassett, Chicago, Ill., assignor to William E. Hale, same place.

359,575 Police telegraph system; Jacob F. Mehren and William Carroll, Chicago, Ill., assignors to the Police Telephone and Signal Company, same place.

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BUSINESS NOTICE.

"In making the statements which follow we can verify each and all of them as facts. Mr. Edward P. Thompson, of Temple Court [7 Beekman St.,] New York, is a good man to bring your patent cases to, for he is thoroughly versed in all the ins and outs of a Patent Attorney's duties. The following are some of his qualifications: Graduate of Stevens Institute as Mechanical Engineer. For four years tutor of classes of young men in mathematics and experimental physics at Elizabeth, N. J. Served professionally as Electrician and Chemist in the Swan Electric Company of New York for two years. Because of past successes as a Patent Attorney at 18 Park Row, New York, was appointed, to succeed N.S. Keith, of the patent agency of the *Electrical World* and Associate Editor. For four years known as the Translator and Reviser of Schellen's Treatise on "Dynamo Electric Machinery." Mr. Thompson for two years personally prepared and prosecuted all the patent business of *Electrical World's* Patent Agency, and is the author of a series of articles in said paper upon "Analytical and Systematic Method of Inventing," which were widely known and favorably received. Mr. Thompson is a member of American Institute of Electrical Engineers and American Society of Mechanical Engineers. He is author of the "Expansion of Polynomials," which the ablest mathematicians of the world universally commend." —*New York Observer.*

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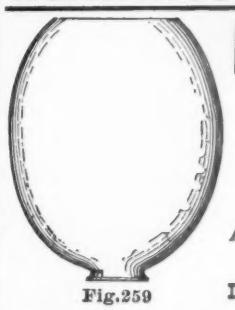

Fig.259

PHOENIX GLASS COMPANY,

(Works, Water Cure, Beaver County, Penn.)

Fig.255

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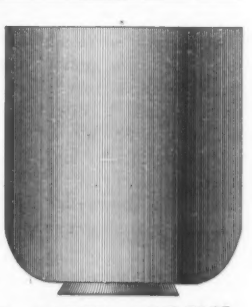

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